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THE AURORA MUNICIPAL PLANT

A COMBINED STREET LIGHTING AND AIR-LIFT PUMPING PLANT FOR WATER-WORKS SERVICE

THIS plant, which is situated on the bank of the Fox River, some mile and a half above the city proper, was started as a waterworks installation in 1886, the intention at that time being to draw filtered water from the river and force it into the mains. The system for filtering, which consisted of a tunnel some 150 ft. long, parallel to the stream, and a reservoir from which the pump suction was to be taken, did not however, prove a success, and bored wells have since been sunk, the water being raised by air lift to a reservoir and pumped by plunger type pumps from this reservoir into the city mains. A standpipe is provided to equalize pressure and give storage for the mains in case of a possible breakdown of the plunger pumps.

Growth and General Arrangement

The station started with a single air compressor which was duplex on the air end and cross-compound on the steam end, and for forcing pumps a pair of Dean cross-compound duplex plunger type. Then in 1894 was added a Nordberg triple-expansion pumping engine, and in 1906 a lighting unit was installed.

With the growth of the city the supply of water became insufficient and an addition was made to the

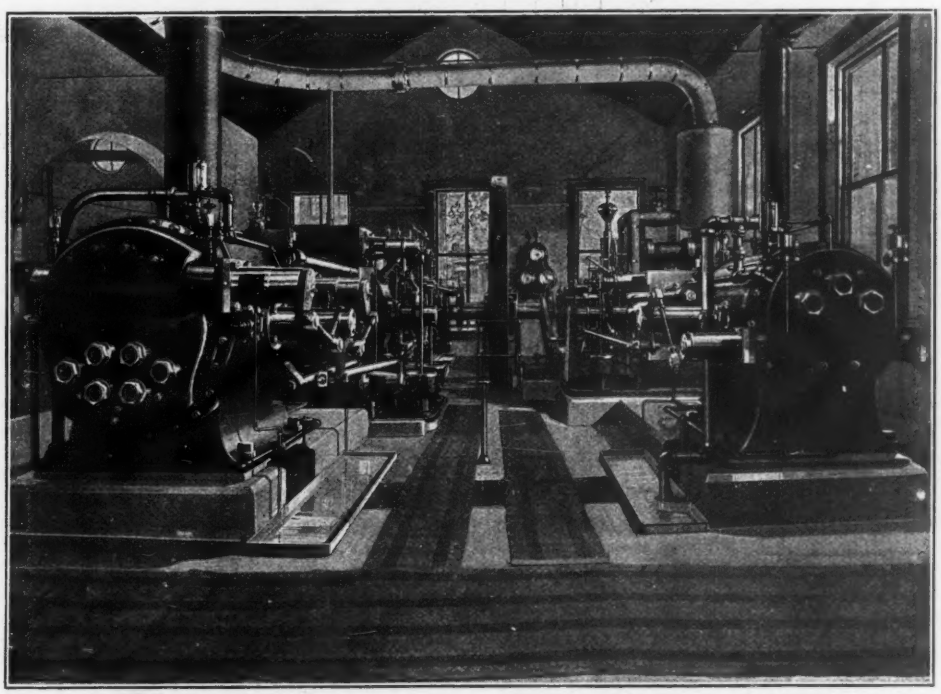


FIG. 5. NEW BATES-CORLISS-AMERICAN CROSS-COMPOUND COMPRESSOR

air lift pumping plant of a new compressor unit with compound air and steam ends and with the addition of this unit in 1908 a rearrangement of the plant was made to the present form.

There are 4 wells from which the present supply is drawn, driven from 2,200 to 2,400 ft. deep and 8 to 12 in. in diameter at the surface and 5 to 6 in. at the bottom. To keep out all surface water they are cased down to rock with iron pipe and are so situated near the bank of the river and with pressure from the hills above that there would be some natural flow but not sufficient for the city supply. The daily average of about 1,600,000 gal. has been pumped during the last year with air pressure at 75 lb.

The 2-in. air pipes run down 240 ft. into the well and the water level is lowered some 50 ft. by the air lift pumping, giving a submergence of 190 ft. The reservoir is concrete lined, one of the wells being in a corner of the reservoir, and is kept overflowing slightly so that the water is continually agitated and purified. The forcing pumps draw water from this reservoir and force it into the mains against a head of 152 ft. maintained in the 18-ft. standpipe on the hill above the station. The standpipe has a capacity of 225,000 gal. and

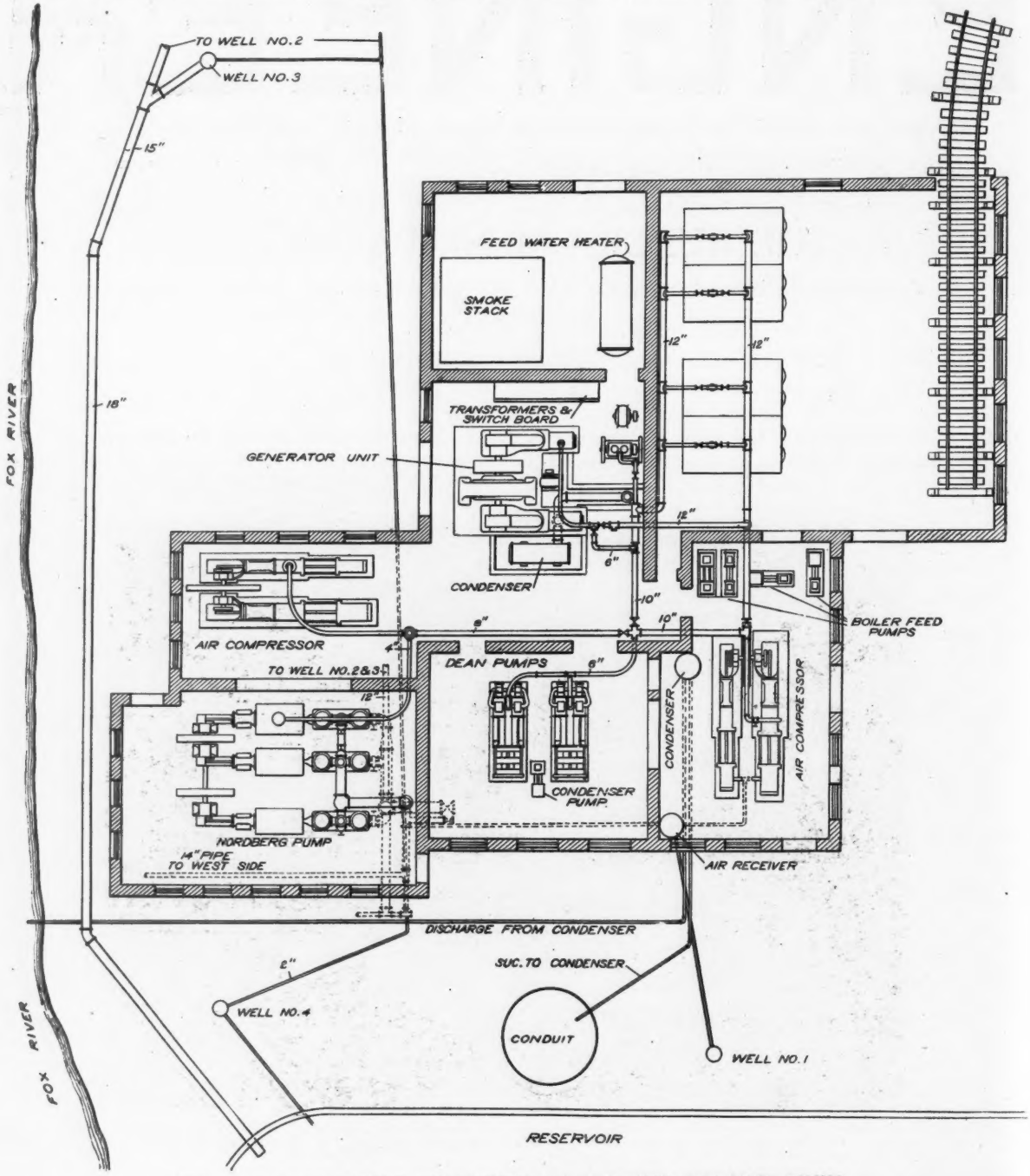


FIG. 2. PLAN OF PRESENT ARRANGEMENT OF MACHINERY AND MAIN PIPING

the reservoir a capacity of 1,300,000 gal., so that there is always in storage a day's supply for the city.

The lighting plant consists of a single generating unit which furnishes current at 2,300 volts, and this is stepped up to 4,400 volts and transformed to constant

FIG. 1. AURORA PLANT AND RESERVOIR

current for the arc lighting circuits, movable coil transformers being used for this purpose. Each circuit carries 50 lights, and 8 circuits are supplied from the station. Besides this a decorative system of street lighting, consisting of ornamental iron poles carrying 3 and 5-light clusters of tungsten lamps, has been provided by the generosity of the citizens in the business portion of the city, and current is supplied to these at 110 volts by a substation located in the city. Lighting for the power plant is supplied by a small generator of 7.5 kw. capacity, belted to a 10-hp. vertical Westinghouse engine.

Detail of Pumping Plant

The compressor first installed consisted of a Corliss steam engine having cylinders 26 and 36 in. in diameter by 14 in. stroke, made by the Bates Machine Co., driving 2 air compressor cylinders 16 in. in diameter, built by the American Well Works, the unit having a capacity of 1,100 cu. ft. per minute. This was installed in 1902, at the time when the supply of water was changed from the filtered river water to the driven well system, and ran until 1908, practically in continuous service, no reserve equipment being available. This compressor is still available for service, but the capacity is not large enough for present demands, and it is, therefore, held as a reserve unit, the new compressor being the one usually kept in service.

The equipment for forcing which was first installed consisted of 2 cross-compound duplex steam pumps made by the Dean Steam Pump Co., of Holyoke, Mass., having 12-in. water cylinders and 14 and 22 by 18-in. steam cylinders. These were supplied with a condenser of the jet type located in the basement and a condenser pump of Knowles manufacture placed between the 2 main pumps. The Nordberg triple expansion pump which was purchased in 1894, has steam cylinders 16, 28 and 39-in. diameter by 36-in. stroke. It was originally equipped with 12-in. plungers, but these gave a greater capacity than was necessary and the speed was kept so low that it was found difficult to control the engine. The cylinders were, therefore, bushed down so that at present there are 2 9-in. and 1 6-in. plungers and the action is found to be entirely satisfactory. A condenser driven from the crosshead of the low-pressure cylinder is located in the basement and takes the steam from this pumping unit.

The new air compressor recently installed is a testimonial to the satisfactory action of the older unit, as it also has Bates steam cylinders and American Well Works air compressor cylinders. It is cross-compound on both steam and air ends, the steam cylinders being 18 and 36-in. diameter, air cylinders 26 and 18-in. diameter, and the stroke 36 in. Air, as already stated, is furnished at 75 lb. pressure, pumped into an air receiver from which it flows in a 2-in. pipe down into the well casings.

This unit is provided with a variable speed device on the governor consisting of a cast-iron disk on the

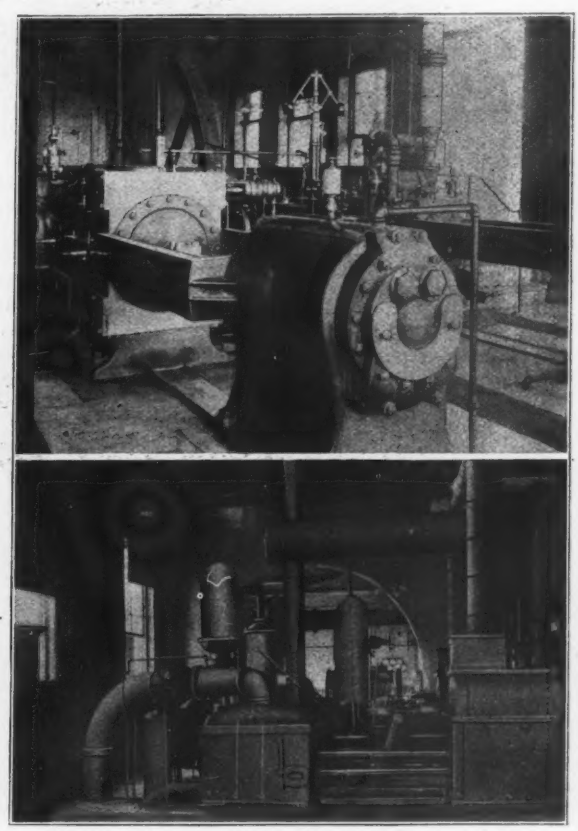


FIG. 3. FIRST UNITS INSTALLED, BATES-CORLISS ENGINE, AMERICAN COMPRESSOR AND DEAN PUMPS

bottom of the governor shaft which is driven by means of a friction wheel belted to the main shaft of the engine. This friction wheel can be moved in and out from the center of the disk, by means of a screw and

hand wheel, thus varying the speed of the governor and, therefore, the speed of the engine, while the engine is running.

The condenser for this unit is of Dean manufacture, of the jet type, with pump 12 and 14 by 18 in., ready been explained. Steam for the light plant is furnished by the same battery of boilers that supplies the pumping engines, the 2 plants being operated jointly by the electrical department and the waterworks department of the city. The arc light circuits are wired

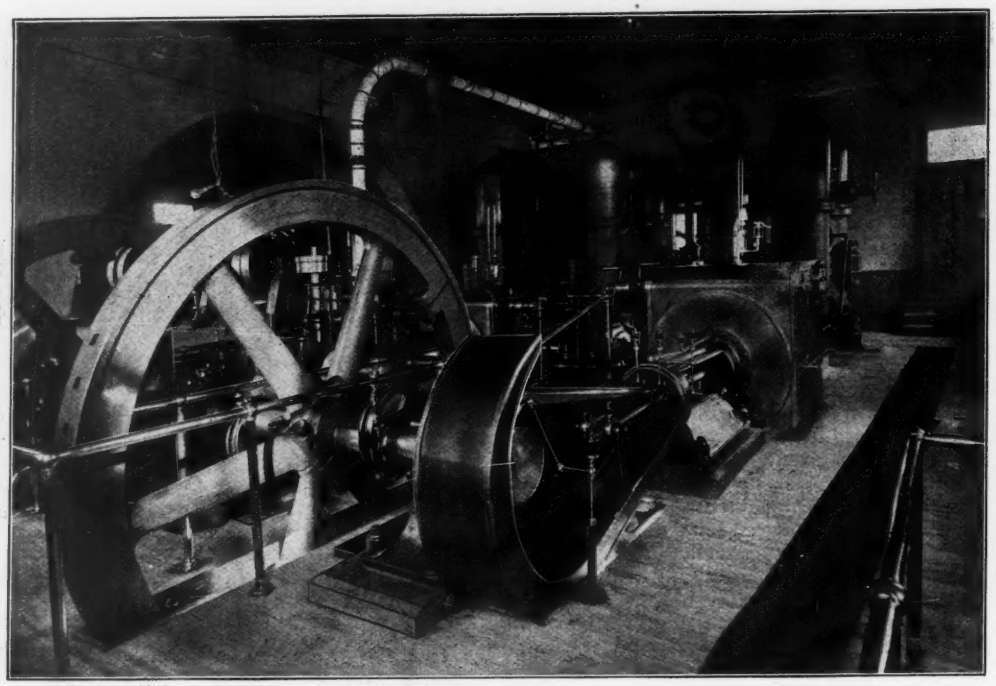


FIG. 4. NORDBERG PUMPING ENGINE

and vacuum breaker. The capacity of the new compressor unit is 1,400 cu. ft. a minute. The capacity of the Dean pressure pump is 1,500,000 gal. apiece and that of the Nordberg unit 6,000,000 gal. The Dean pumps have been in regular service for 20 yr. and are still working regularly.

with No. 6 weatherproof on poles and No. 6 lead-covered cable in conduit, and supply 418 long-burning enclosed alternating-current arc lamps.

The decorative lighting system has 247 3-light poles

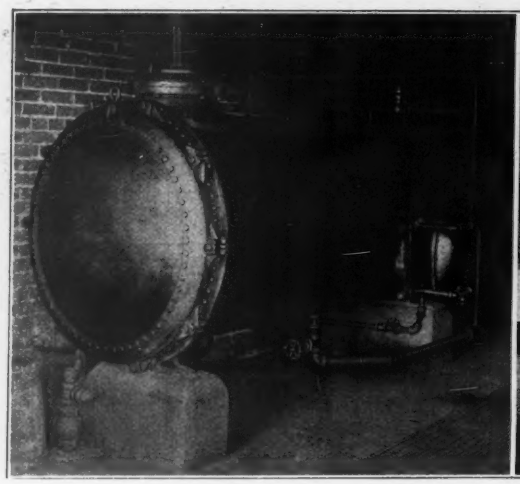


FIG. 6. BARAGWANATH OPEN HEATER

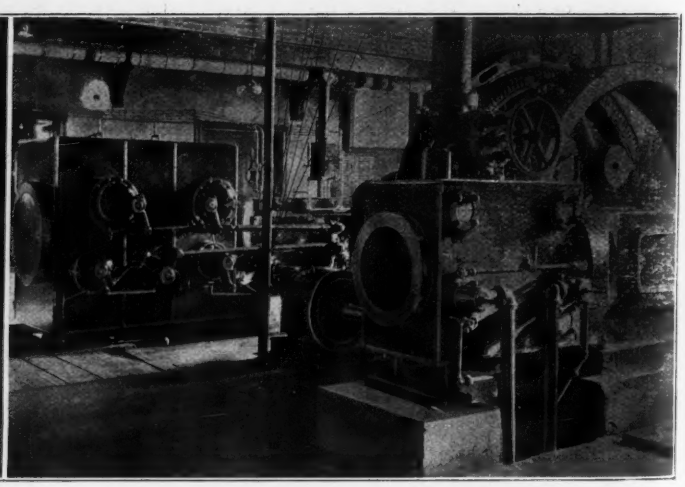


FIG. 9. BALL ENGINE AND WESTERN ELECTRIC GENERATOR

Details of Lighting System

The general scheme of the lighting system has already been explained. Steam for the light plant is furnished by the same battery of boilers that supplies the pumping engines, the 2 plants being operated jointly by the electrical department and the waterworks department of the city. The arc light circuits are wired at intervals of 50 ft. apart, opposite each other on both sides of the street and 45 5-light poles at the street intersections; 3-light poles each have 2 100-watt and 1 60-watt tungsten lamps in 12-in. opalescent globes. and the 5-light poles have 4 150-watt and 1 60-watt

lamps. The wiring is laid in iron conduit in an extra curbing on which the poles are placed. The system is subdivided into 11 separate sections, each protected by a fuse and each pole also has fuse protection.

The generating unit consists of an engine of the high-speed 4-valve type, cylinders 16 and 24 by 36 in. in diameter, made by the Ball Engine Co., of Erie, Pa., exhausting into a Dean jet condenser and having also an atmospheric exhaust line extending through the roof of the station. This drives direct a 300-kw. Western Electric generator, furnishing 2-phase currents at 2,300 volts to the switchboard.

From the busbars connection is made to the transformers located above the switchboard and from these to the different circuit feeders and also a line is carried to the downtown substation. Exciting current is furnished by a belted Western Electric generator of 12-kw. capacity, furnishing current at 125 volts and running at 1,200 r. p. m. The switchboard connections are as indicated on the diagram.

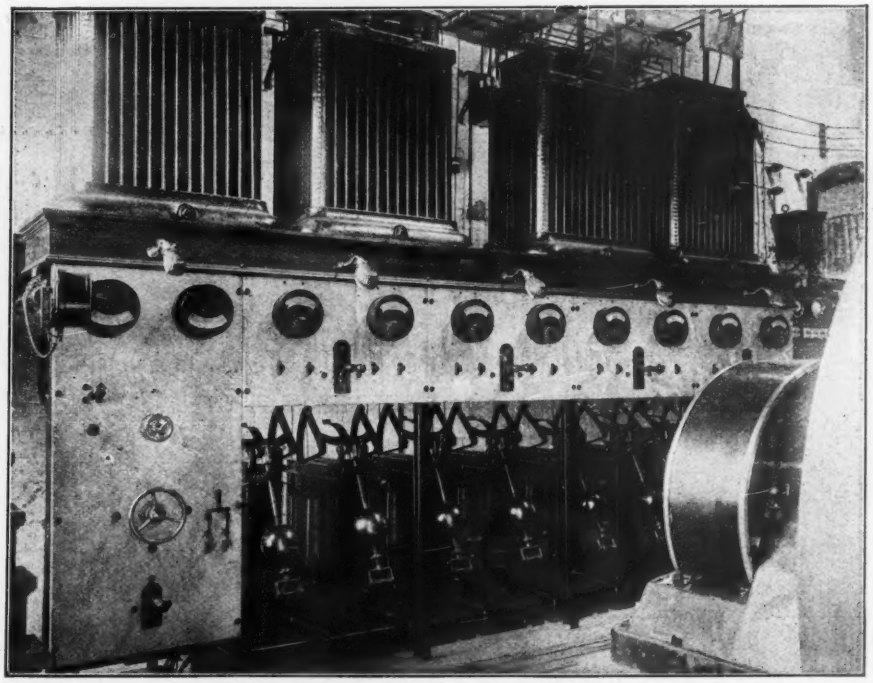


FIG. 7. SWITCHBOARD, TRANSFORMERS AND CONSTANT CURRENT REGULATORS

Boiler Plant

Steam for the system is supplied by 4 Babcock & Wilcox boilers of 230 hp. each, set 2 in a battery. These are equipped with Reliance water columns and Martin shaking grates, the coal used being Illinois screenings, 1.5-in. screen from Franklin County. Steam is carried away by 2 12-in. headers, one running across the front of the boiler, the other across the back, the connections being made by curved bends with shut-

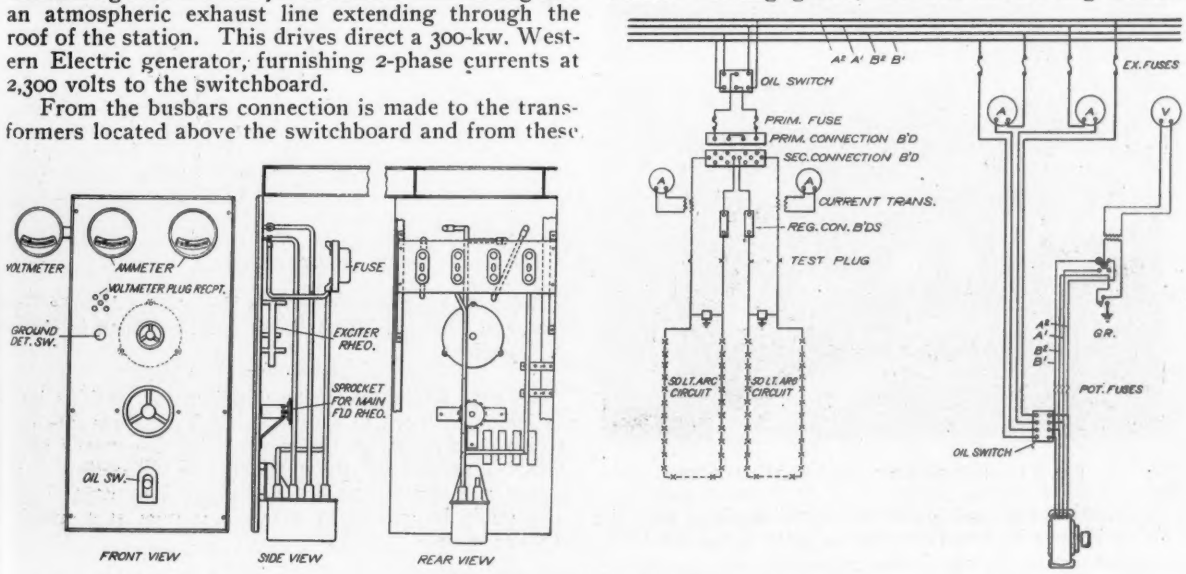


FIG. 8. SWITCHBOARD CONNECTIONS

off valves at the highest point of the bends so that no condensation will collect in either side.

Feed water piping is also installed in duplicate, either front or back feeding being available from either one of 3 pumps. These pumps are located in the room with the older air compressor unit, one of these being a Knowles duplex pump 7.5 and 4.5 by 12 in., one a Knowles single feed 10 and 6 by 12 in., and one a single

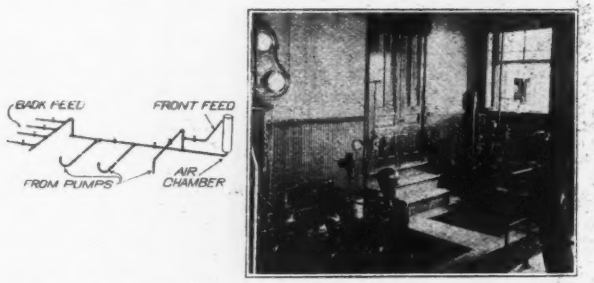


FIG. 10. FEED-WATER PIPING AND BOILER FEED PUMPS

feed 7 and 5 by 10 in. The arrangement of the connections from pumps to boiler feeding lines is shown in Fig. 10. The suction of these pumps may be taken either from the feed-water heater or from the hot well.

The heater, which is a 500-hp. open type made by Wm. Baragwanath & Son, of Chicago, heats the water to from 190 to 200 deg. and the installation of this heater and of the shaking grates, which was made in 1907, is estimated to have reduced the coal bill from $11,000 in 1905 to $8,000 in 1908.

The steam supply pipes are reduced from the 12-in. header to 10 and 8-in. for supplying the different pumps and engine units, as indicated in the diagram of piping connections. In all cases long bends are used to take care of the expansion and piping is well covered to prevent condensation.

Coal is brought into the boiler room in cars on an

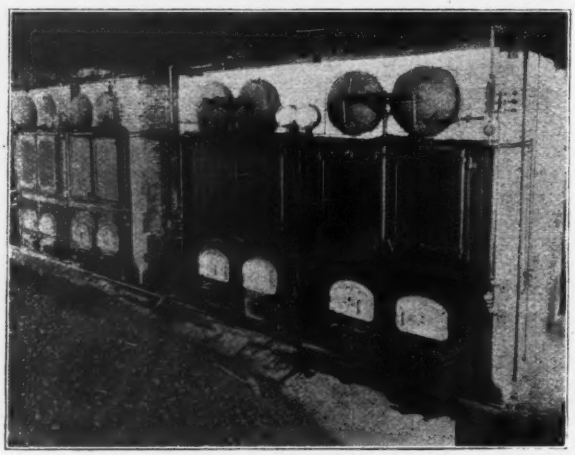


FIG. 11. BOILER ROOM AND COAL STORAGE

overhead track and unloaded by dumping, and the firing is done by hand on shaking grates, the ash being carried out in the usual way in barrels.

Special provision is made at the bottom of the standpipe so that in case of fire a valve in the main leading to the pipe can be closed and a pressure of 120 lb. is thrown on the system and maintained there so long as the fire continues. To close this valve in the standpipe a pump, 7 and 4.5 by 10 in. is provided which raises the pressure under the valve to 120 lbs., throwing it closed, and this pressure is then maintained by speeding up the main pumps.

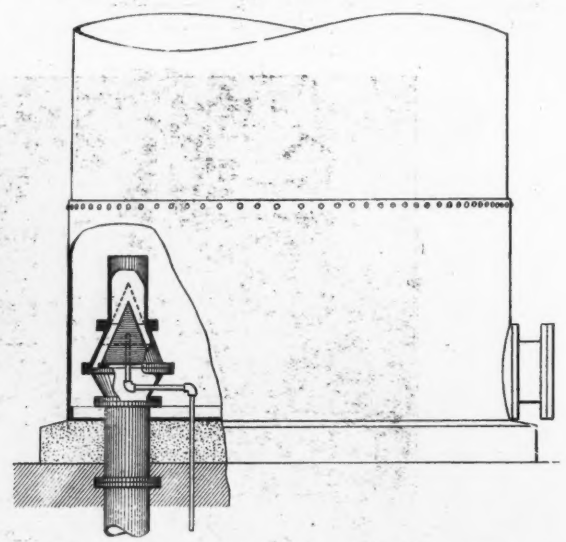


FIG. 12. EMERGENCY VALVE TO CLOSE STAND PIPE

The economic operation and fine condition of the station, as well as of the entire system, is in a large degree due to the efficient co-operation between T. D

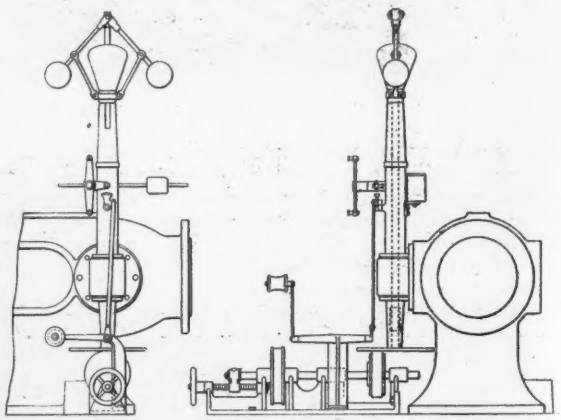


FIG. 13. VARIABLE SPEED ARRANGEMENT FOR BATES AIR COMPRESSOR

Stinson, the superintendent of the Water Works System, and Chas. F. Mitchell, the chief engineer in charge of the plant.

A NEW GASOLINE MOTOR designed for airships has 5 cylinders fastened to a central crank, to form one body which revolves about the center. By this means no fly wheel is needed and the cylinders are self-cooling. The motor will develop 72 hp. but weighs only 97¼ lb. and can easily be carried by 2 men. It runs at a speed of 1,600 r. p. m.

SOME IDEA OF THE sun's heat is given by an illustration stated by Herschel. If a column of ice could be built from the earth to the sun, 93,000,000 miles and 2.25 miles in diameter, the radiation from the sun if concentrated on this column would melt it in a single second, and in 7 seconds more turn it to steam.

LARGE WATER SOFTENING PLANT

IN the spring of 1908, the John Wildi Evaporated Milk Co., of Highland, Ill., built a new plant at Marysville, Ohio. Its steam generating equipment consisted of 6 100 hp. tubular boilers. In the first 3 months of operation, it was found that the water supply was very bad and that the boiler compound and an elaborate system of heaters would not prevent vast amounts of scale from forming in the boilers.

The water used is from a deep well which is forced into tanks and flows by gravity from them to the milk

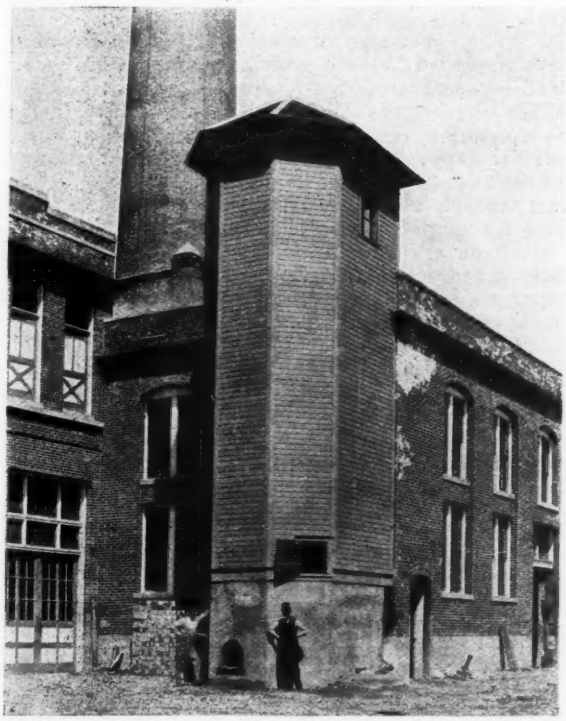


FIG. 1. HOUSED-IN WATER SOFTENER OF THE JOHN WILDI EVAPORATED MILK CO.

sterilizers, which heat the flowing water to over 150 deg. From these sterilizers, it flows to a cistern and is pumped from there for boiler purposes, at a temperature of about 112 deg. It became necessary that the boilers and heaters should be cleaned every week and nearly a barrel of boiler compound used to prevent serious trouble and the waste of enormous quantities of fuel.

To overcome this expensive treatment and extra consumption of coal, the company installed a 2,500-gal. per hour automatic and continuous water softener, manufactured by the Gem City Boiler Co., of Dayton, Ohio, which has eliminated the scale-forming properties from the water by reducing the hardness of the water to 4 deg. from an original hardness in the cistern of 64.21 and an alkalinity of 14.31. It is not necessary now to open the boilers or heaters within 3 to 4 months, as the water is perfectly soft and free from organic matter.

Figure 1 shows the softener to be housed in to retain as much of the heat from the warm water as is possible. The chemical solution reagent tank is on the ground floor in the brick building near the base of the softener, as is also the stairway to the top of the softener, where the water measuring and proportioning device is located, which in the operator's opinion is the simplest arrangement. In the Russell softener is a system of cones in the bottom of the main settling tank which prevents an undue amount of treated water being discharged when the sludge valve is opened for its removal, and they also act as an accelerator for precipitation. Ordinary labor can be employed to mix up the softening solutions as means are provided to prevent mistakes.

A letter from the John Wildi Evaporated Milk Co. states that they cannot think of any feature that would further improve the outfit, which speaks well for the designers of the plant, especially as this was the first softener installed by the Gem City Boiler Co.

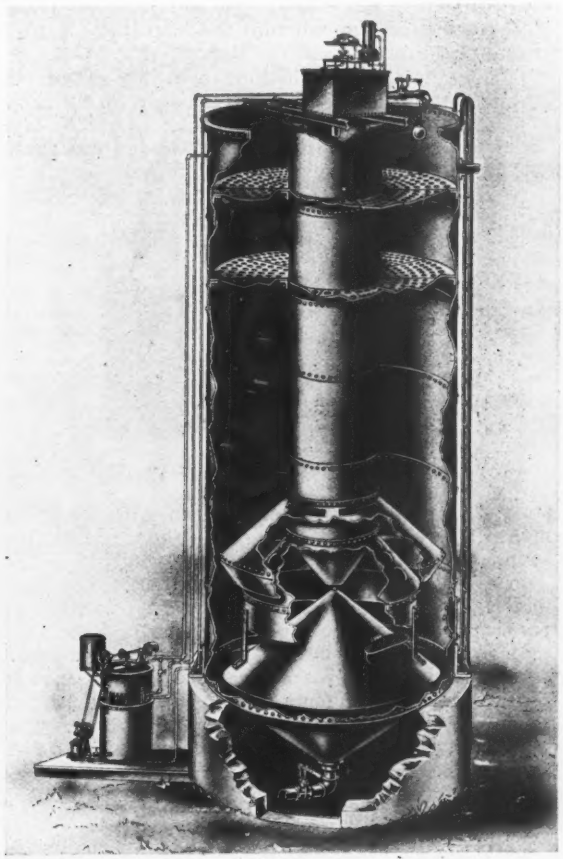


FIG. 2. SECTIONAL VIEW OF RUSSELL WATER SOFTENER

FOR GRINDING TWIST DRILLS, care should be taken to have the 2 lips of the same length and at the same angle, an included angle of 118 to 120 deg. being found the best. The Cleveland Twist Drill Co. advocates a clearance on the lip of 12 to 15 deg. at the outside of the drill, increasing toward the point which should have an angle of 135 deg. with the front or cutting edge of the lip.

WHEN IT IS DESIRED to cover an iron pulley with rubber, the surface should be thoroughly cleaned, and then washed with muriatic acid, and let stand overnight. Then give the iron and rubber each a good coat of heavy yellow shellac varnish, apply the rubber to the pulley and clamp it on, allowing it to stand until thoroughly set. This method is given by E. B. Gaskey, in Machinery.

HOW THE NEW CHIEF MADE GOOD

A DEFINITE UNDERSTANDING

By George H. Wallace

"YES, gentlemen, we are right up against it," continued Gautelbeim. "We have reached the last ditch. Our new superintendent, Mr. Mather, tells me that we have got to spend another $75,000 to $100,000 for power before we can make money! Think of it! Before we can make money." "Here, Willie," to the office boy, "go and hunt up Charlie Mather at once and tell him the board wants to see him in the director's room. Run now.

While the boy was looking over the entire plant for Mr. Mather, the financial struggle of the Board went on amid the fragrant aroma of the filthy weed. In due time the superintendent arrived and was greeted by Gautelbeim with a cigar, a handshake and a cold

"LOOK THAT OVER PLEASE"

stare. "Mr. Mather, you have been with us about a month now and ought to begin to show results pretty soon. Can you give us any encouragement?"

"Mr. Chairman and gentlemen, it has been a great undertaking for me to come here and try to show even poor results under existing conditions. You tell me that you have been having no results in the past, so poor results certainly are an improvement. But it is too much for one man to do, especially as the field to be covered is a broad one, and part of it entirely outside of my line of training. Therefore, I have hired a new cheif engineer at $125 per month."

"You have what!" roared Gautelbeim, as he banged the table with his massive fist.

"As I was saying," continued Mather quietly, "I have hired a new man to take entire charge of heat, light and power for us at $125 a month. I have promised him that, if he makes good, he will get more, and the more he makes for us—you—the more he will get. He has arrived in the city and we were looking over the situation when you sent for me."

"Where is he?" thundered Gautelbeim in a voice that made the windows rattle.

"Out in the office," replied Mather.

"Call him in!"

Presently Mr. Mather returned with the new chief engineer, a heavy set young man of perhaps 35, well built, muscular, not an ounce of surperfluous flesh about him, a stern brown eye, well set in a well-shaped head surmounted by a wealth of dark brown hair that was prone to droop over his forehead.

"Mr. Gautelbeim, this is George Willard, our new chief engineer," said Mr. Mather, introducing them. They approached and the massive right hands clasped like the grip of clamshell bucket. Their eyes met, the cold steel gray and the stern brow. Each looked into the very depths of the other, taking his measure, reading him, searching the inner recesses of his strength. Thus they stood, and fought the noiseless battle. The gray eye weakens and shifts beyond the mark for the fraction of an instant. Gautelbeim moistened his dry lips, wavered again—and capitulated:

"Well—I'm—glad to know you Mr. Willard," he said with hesitancy as he rustled some papers on his desk.

"Your expression of good will is indeed reciprocated," replied Willard with considerable firmness.

The usual preliminaries over with, the battle of words was begun. Willard didn't say much. In fact, he was one of those individuals rarely met with, who has the happy faculty of making the other fellow do all the talking, whether he wants to or not, and when this valuable asset is a part of the make-up of an engineer, enough has been said.

Whenever Gautelbeim thought he was through talking and desired some expression from Willard, the latter would brush aside a truant brown lock from his brow and in a gentle, firm voice, would say with a rising inflection, "yes?" and to save his soul, John Gautelbeim couldn't help letting the entire cat and its nine lives out of the bag and told Willard all about their past mistakes.

The only words spoken were an occasional "yes," and a "next chapter" reply from Gautelbeim. Finally, he said: "But what are you going to do Mr. Willard? We don't need another engineer and throw away $125 a month after several hundred thousand more that has gone before. We have 7 engineers now. Where do you come in? What are you going to do to earn your money?"

"Look that over please," said Willard as he handed Mr. Gautelbeim the agreement drawn up between himself and Superintendent Mather, to run for one year.

The general manager ran it over with a quick critical eye gained by long practice, but judging from past experiences and having in mind the gas engine deal, he could see nothing but a new shape of gold brick that was about to be worked off on him. It was a gold brick, but the genuine goods, and he didn't know it.

"I can't have this! I can't have this! I'll not tolerate it for a moment!" stormed Gautelbeim as he finished reading it and pounded the table with his fist.

"Very well then, please write me out a check for $1,500, will you, Mr. Gautelbeim?" said Willard with a faint smile.

"I will not! What for?

"A year's salary."

"A year's salary!" bellowed Gautelbeim, choking with wrath. "Well—I—like—your—nerve!"

"You understood me corectly Mr. Gautelbeim. Yes it does require nerve to go up against a proposition such as you have here," said Willard in a calm voice.

"Young man do you refer to me personally or to our works?"

"Well—both!"

"This is the height of insolence! Young man, you get out of here before I throw you out!"

"But the check?"

"What check?"

"Why that check for $1,500."

"What for?"

"Mr. Gautelbeim, are you aware of the fact that it is law, that a firm is responsible for the acts of its agents?"

"Well!"

"Mr. Mather over there has a contract with you running 5 yr. from date, which empowers him to hire such assistance as is in his judgment necessary properly to operate the works. He has seen fit to engage my services. Now what are you going to do about it?"

Every rocket mounts into the air with a mighty rush, explodes with a boom and attracts every eye while the sparks dash hither and yon, float about in the heavens, twinkle feebly—and die; and its pretty display is soon forgotten.

Gautelbeim sat down in his chair, breathed heavily, clutched the corner of the large table with one hand, the other resting on his knee, his fingers twitching nervously, while he gazed vacantly at the center of the office rug.

"Is this so, Mr. Mather?" he said, at length, almost in a whisper.

"It is," replied the latter.

"Then—so—be it."

"Thank you Mr. Gautelbeim," said Willard in the same calm manner that characterized him so strongly.

"I'M GOING TO RUN THE POWER END OF THIS PLANT"

"Now that we understand the matter thoroughly, it isn't a case of whether I can have a position with your firm or not, but whether I want it."

Gautelbeim looked up, thoroughly cowed, looking 10 yr. older. "Well?" said he pleadingly.

"Well," said Willard, "I don't want it."

"No, no, no! Mr. Willard, don't say that! Don't say that! Stay, I beg of you to stay!" almost whimpered the general manager.

"Very well then, Mr. Gautelbeim, I will stay. But let it be understood right here and now, once and for all, I'm going to run the power end of this plant and everything connected with it by a pipe or wire, and I'll tolerate no interference from any man connected with this firm, not even the president and chairman of the Board of Directors. You're an office man. You don't know an engine from a flue scraper. I'm an engineer. Mr. Mather knows whether I know my business or not. I'm going to spend a lot of money for you—to make money. Let's go Mr. Mather." And as the superintendent and the new chief engineer left the room, another rocket started heavenward, but they neither saw nor heard it, neither did they care if the whole pyrotechnic display went up in the air at once. (To be continued.)

BOILER CAPACITY AND EFFICIENCY

OLD notions regarding boiler capacity are rapidly giving away to modern ideas. The boiler of the future will not be operated at comparatively light load in the hope of getting high efficiency, as has been thought necessary, but will be compelled to evaporate 2 to 4 times the present rating. Experiments prove that the boiler surface will efficiently transmit the heat units much faster than it is called upon to do at present; therefore attention is being directed to the furnace and methods of stoking in order that more of these units may be supplied efficiently.

To furnish a boiler with more heat units means not merely more coal and more draft, but in addition more nearly complete combustion, and a reduction in the excessive amount of air passing through the furnace.

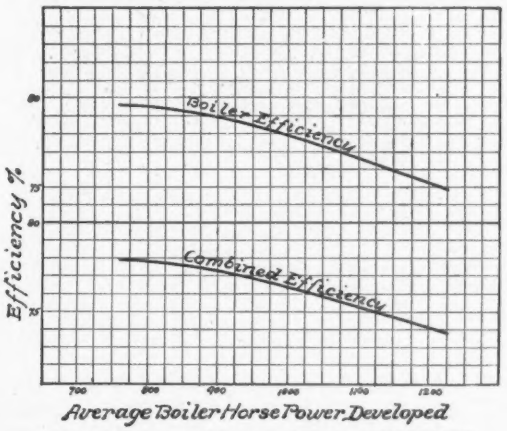
TABLE. RESULTS OF TEST OF B. AND W. BOILERS EQUIPPED WITH TAYLOR GRAVITY-UNDERFEED STOKER. TEST MADE BY NEW YORK EDISON CO.

TEST NO.	DURATION HR.	HORSE POWER MAX. PER HR.	HORSE POWER % OF RATING MAX. HR.	EQUIVALENT WATER PER LB. COMB. BURNED	EQUIVALENT WATER PER SQ. FT. H.S. PER HR.	DRY COAL FIRED PER SQ. FT. GRATE PER HR.	STEAM PRESSURE	DRAFT INCHES OF WATER: FURNACE	FLUE	ASH PIT	TOTAL	GAS ANALYSIS: CO_2	O	CO	HEAT BALANCE: BOILER EFF.	FURNACE & GRATE EFF.	COMBINED EFF.	PERCENTAGE LOSS IN FLUE GAS
6	8	818	125.8	12.78	4.18	21.1	193.4	0.38	0.55	1.8	2.89	13.9	5.9	0	78.9	89.0	78.5	10.6
10	8	987	151.9	13.16	4.45	22.71	194.0	0.48	0.70	2.1	3.56	12.8	7.5	0	80.7	88.7	79.6	12.2
7	8	1022	157.2	12.94	4.52	23.08	193.7	0.38	0.59	2.1	3.48	13.0	6.2	0	80.9	88.6	79.8	11.3
8	8	1001	154.0	12.54	4.61	24.3	191.7	0.39	0.62	2.1	3.49	12.7	6.5	0	78.7	88.0	77.1	12.1
9	8	917	141.1	12.38	4.61	24.05	195.8	0.45	0.63	2.0	3.45	13.5	5.8	0	75.8	89.3	74.3	11.1
4	8	1068	164.5	12.76	4.82	25.3	196.0	0.37	0.64	2.2	3.51	13.5	4.7	0	80.0	91.0	77.8	12.2
5	8	1094	168.3	12.57	4.99	25.86	194.1	0.37	0.54	2.2	3.51	14.2	1.4	0.5	77.6	93.6	76.5	9.4
1	3.85	1246	191.7	12.21	6.51	35.1	193.2	0.35	0.65	2.9	3.24	16.5	1.3	0.2	74.5	97.6	72.7	10.4

The trend of combustion engineering is toward these features; what surprises engineers being the fact that with properly designed furnaces and stokers there is so little decrease in efficiency with even great increase in output.

At the Waterside Station of the New York Edison Co., a 650-hp. Babcock and Wilcox boiler, equipped with a Taylor gravity-underfeed stoker, was given a series of tests by the engineers of the Edison Co. The results of these 8 tests are given in an abridged form by the accompanying table, and the relation of the boiler capacity to its efficiency is shown graphically by the curves.

When the output was increased from 125.8 per cent of the rated capacity to 191.7 per cent, the combined efficiency of boiler and furnace dropped but 7.1



EFFICIENCY CURVES OF STEAM GENERATOR

per cent, or from 79.8 to 72.7, a result due largely to correct and absolute control of both coal and air by the stoker. The table shows also that the efficiency of the boiler was reduced only from 80.9 per cent to 74.5. Such results can be obtained only when the combustion is much more nearly perfect than is generally the case, and a glance at the columns giving the gas analysis shows that the percentage of carbon dioxide was high, while the carbon monoxide was low, sure indications of excellent combustion.

GAS ENGINES AND PRODUCERS

THE FIELD GAS ENGINE

ALTHOUGH the operation and principle of internal combustion engines are simple, when one of this class of engines is out of order, the difficulty will be found, in nearly all cases, to be some trouble with a detail part of the engine. In the Field gas engine, which is illustrated herewith, special attention has been given to every detail and the results in simplicity of design which have been obtained are well worth commenting upon.

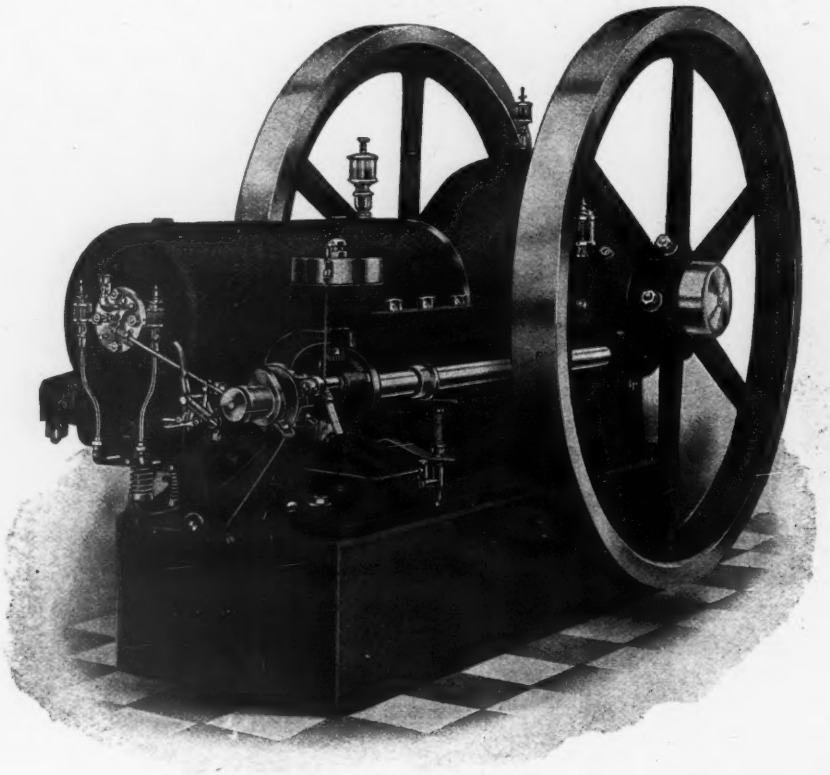


FIG. 1. FIELD GAS ENGINE

These engines are built in capacities ranging from 4 to 30 hp. and they are all equipped with an automatic starter.

The cylinder and combustion chambers are of unique design, being cast in 1 piece, as illustrated in Fig. 3, with no packing joints exposed to the explosion. It will be noted also that both exhaust and inlet valves are mechanically operated and are located in removable cages, work in a vertical position and both valves stems are lubricated.

The exhaust cam is provided with 2 paths, 1 path reduces the compression so that the engine may easily be turned over by hand for starting on gas where the use of gasoline is prohibited. A shifting roller is placed on the exhaust lever to shift from the above described path to the working path of the cam. This also is valuable where one desires to start engines of large size on compressed air, as a very low pressure of air can be used.

A point worthy of note in the design of this engine is that the piston can be taken out without removing anything except the oil guard. All engines of 6 hp. and larger are equipped with a counter-balanced crank shaft protected by a cast-iron shield, fitted to allow access to the crank bearings, and which also serves as an oil guard.

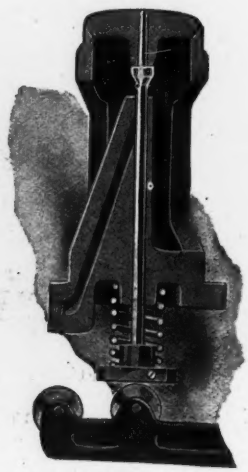


FIG. 2. SECTIONAL VIEW OF VALVE

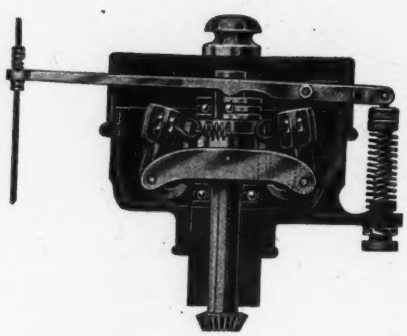


FIG. 4. GOVERNOR MECHANISM EMPLOYED IN FIELD ENGINE

The governor is entirely enclosed in a polished case, runs in oil and is equipped with ball thrust bear-

ings, both top and bottom, which make it very sensitive. The spark can be advanced or retarded on all engines and the speed of the engine may be changed while the engine is in operation without handling any moving part.

The side shaft is driven all of the time by means of spiral gears which work in oil. The inlet cam floats on the side shaft and is handled by a simple but strong clutch. When the governor hooks up the exhaust lever, the clutch is mechanically cut out and the inlet cam is idle, thereby stopping the igniter and intake

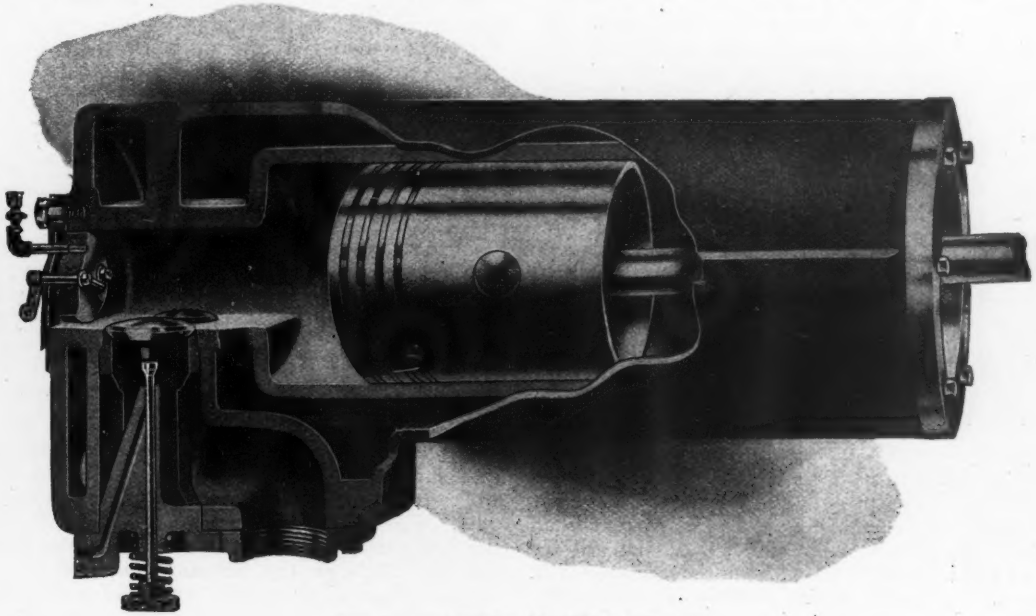


FIG. 3. CYLINDER OF FIELD ENGINE

lever, saving wear on these parts, and keeping the inlet valve closed when the engine is hooked up makes it economical in the consumption of fuel.

A distinctive feature of this gas engine is that the igniter can be cleaned while the engine is running. The movable electrode passes through an out board bearing, giving long life to the igniter and the trip rod is

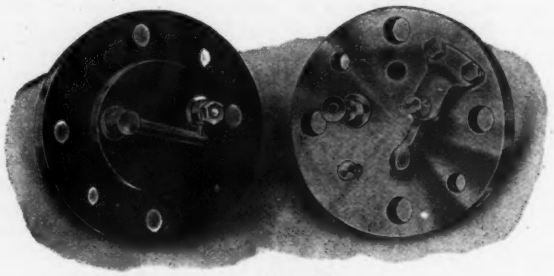


FIG. 5. FIELD ENGINE IGNITER

provided with means for adjustment so that, as the electrode wears away, the rod can be lengthened and the electrode can be worn entirely out.

This engine is the product of the Field-Brundage Co. of Jackson, Mich., and is a good example of the advanced state of gas engine manufacture.

TO SOLDER COPPER WIRES, where the use of acid is objectionable, a paste which will not spatter or corrode is made of a saturated solution of chloride of zinc, 1 dram, and gasoline, 1.5 oz.

DRY BATTERIES FOR IGNITION IN GAS ENGINE PRACTICE*

By A. L. HASKELL

TO GIVE a clear understanding of the dry battery, it would be well to take up in a general way some of the elemental facts in connection with its manufacture. The essential constituents of a battery of this type consist of a carbon pole and a zinc pole, forming the positive and negative, placed in a solution of sal-ammoniac as the electrolyte. In a battery of this kind as soon as the circuit is completed and the current begins to flow, hydrogen gas is evolved and collects on the carbon pole. This gas forms an insulator which prevents the flow of current, an action which is known as polarization. When a battery is used as a source of energy for some time it is necessary to take care of this gas, and this is done by introducing black oxide of manganese, which absorbs the hydrogen gas, thereby acting as a depolarizer.

The zinc which forms the negative pole is made up in the form of a can, and is used as the container for the other elements in the battery. Next to this zinc can comes a lining of paper saturated with the electrolyte; then comes a moist mixture composed of carbon flour and black oxide of manganese, and in the center is a carbon plug, forming the positive pole of the battery.

After the mixture is tamped in around the carbon plug the battery is sealed with a compound which keeps the moisture in the mixture and prevents any spilling while the battery is being handled. This process is very simple, and can be depended on to give satisfactory results, provided due care is used in the selection of raw materials and throughout the whole course of manufacture. The proper selection of material, the proportions in which these materials are compounded, and the care used in manufacture, are the determining elements in the quality of the dry cell.

Any foreign elements introduced into the battery

*Abstract of paper read before the National Gas Engine Trade Association.

or any carelessness in the assembling is apt to result disastrously, and it is necessary that every precaution be taken to prevent such a possibility. The batteries are tested a number of times in the course of manufacture, are then seasoned for a sufficient length of time to allow any internal defect to show itself, then subjected to a final inspection and test before shipment. This factory inspection is very necessary to insure the customers getting a uniform and satisfactory product, for, as we will now show, it is practically impossible for the user to determine beforehand whether the battery he is buying is a good one or a poor one.

Tests made of batteries show that frequently cells which give the highest current when first made will

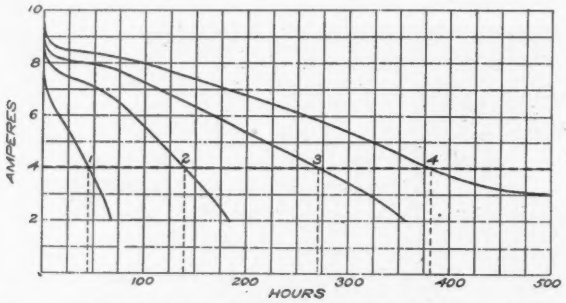


FIG. 1. SERVICE LIFE OF BATTERIES ON IGNITION UNDER DIFFERENT CONNECTIONS AT RATE OF 0.25 AMPERE

give very low current when put into service after standing for some time, but a high current value from the battery when short circuited does not necessarily mean a good battery, as this amount of current is an indication of the internal resistance of the battery only, and has nothing to do with the service side of it. An internal mixture consisting entirely of active chemicals with a high resistance might give a high internal resistance to the battery and the resulting first current would be low although the service life obtained from the battery might be good.

The amount of current drawn from the battery depends directly on the length of contact of the timer, whether for make-and-break or jump-spark ignition, on the resistance of the coils used, and in the case of jump-spark coils on the adjustment of the vibrator. There is a great variation, in jump-spark coils especially, in the amount of current required to operate an engine properly.

Some of the ignition devices, using a mechanical make-and-break with a nonvibrating coil, will operate a 4-cylinder engine on an average current consumption of from 0.1 to 0.2 amp. and develop the maximum amount of power from the engine. There are coils of the vibrator type that will do the same thing on an average drain of 0.2 to 0.3 amp. With a coil of either of these types the user is practically assured of getting perfect service from dry cells.

Tests made on batteries with the oscillograph, an instrument for measuring the instantaneous values of current, showed that the actual current impulse in the primary is only about ⅓ the impulse measured by short circuiting the batteries through the primaries of the coil. As the vibrator was tightened, the average current consumption increased from 150 to 550 per cent, according to the number of cells in series, while the actual impulse measured by the oscillograph increased only from 10 to 25 per cent, so that there is little advantage to be gained by tightening the vibrator on a coil beyond the point where the current first becomes steady and even.

Tests with a nonvibrating coil and a mechanical contact maker in which the timer revolved at about 500 r. p. m. showed that although the short circuit impulses are higher with the vibrating coil, each contact is of shorter duration than in the case of the vibrating coil. The current impulse is nearly as high as with the vibrating coil although the average current is much less, which shows that any current in excess of that necessary to ignite the mixture is wasteful.

It has been found by experiment that with usual types of coils, dry cells are capable of giving efficient service as long as they will deliver an impulse of 3 to 4 amp. when short-circuited through the primary circuit of a coil by holding the vibrator points in contact.

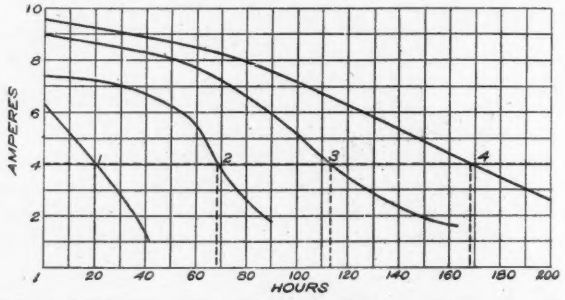


FIG. 2. SERVICE LIFE OF BATTERIES AT RATE OF 0.5 AMPERE

In Fig. 1, curves are shown indicating the discharge of batteries on ignition service when the average current with the engine running is 0.25 of an ampere. The figures 2, 4, 6, etc., on the left hand, show the impulse in amperes when the batteries are short-circuited through the primary coil, and the figures marked "hours" show the length of time they have been running when these readings were taken. The dotted line starting at 4 and running across the page indicates what we consider as the dead point of the batteries—namely, when they are no longer capable of delivering an impulse of more than 4 amperes through the coil.

The first curve shows the discharge from a single set of cells which reached the dead point at the end of 48 hr. The second curve shows the discharge of a battery composed of 2 sets in multiple, and these reached the dead point at the end of 140 hr. The third curve is for 3 sets in multiple which reached the dead point at the end of 270 hr. The fourth curve, showing 4 sets of cells in multiple, reached the dead point at the end of 383 hr.

Figure 2 shows a similar set of curves when the average discharge is 0.5 amp. continuously. Here the single set of cells runs for 20 hr.; 2 sets in multiple for 70 hr.; 3 sets in multiple for 114 hr., and 4 sets in multiple 170 hr. Figure 1 represents the conditions actually obtained with an efficient ignition apparatus properly adjusted and is being duplicated every day in practice. Figure 2 represents conditions met with in every-day practice when an average type of ignition apparatus with average adjustment is being used.

Another obvious advantage of the multiple connection is that batteries can be used to a much lower point when connected in multiple than when used in single series. As shown above, it is necessary for a battery to deliver an impulse of 4 amp. through a coil to give satisfactory service. If 4 sets are connected in multiple it will be necessary for each set of cells to deliver only 1 amp. impulse through the cell, and

the battery can therefore be used much nearer to the point of complete exhaustion.

With regard to the number of cells to be used in series, it is hard to lay down a definite rule, as the voltage required depends on the type of coil used and the condition of the contact in the timer. A great many coils and timers will operate satisfactorily with 4 cells in series on a multiple battery and practically all of them will operate satisfactorily with 5 in each series when connected in multiple. By connecting 3 or 4 sets in multiple it is usually practicable to use 1 less in series than when used in single sets; that is, if a single set of 6 batteries is ordinarily used, when the multiple connection is made it would be found that 5 in series is sufficient.

With regard to the number of sets to be used in multiple, the object should be to provide a battery that will run from 9 months to a year, and this, of course, depends on the amount of current required and the amount that the engine is run.

With regard to the length of contact of timer necessary on a stationary engine, we have not been able to get as complete results as we would wish, due to the difficulty of getting a standard type of make-and-break apparatus. We would suggest, however, from results that we have obtained, that a length of contact of from 20 to 26 deg. on the flywheel of an engine running 600 r. p. m. would be sufficient. This would give a contact of about ½ that number of degrees on the timer shaft in the case of a 4-cycle engine. If the speed were higher the length of contact would have to be lengthened proportionately, and if lower would be shortened proportionately.

LONDON LETTER

TANGYE GAS ENGINE DETAILS

By W. A. Tookey

Breech End

THE method of governing by throttling the volume of a mixture of uniform composition, renders it obligatory to arrange for high compression pressures under full load, in order that, when the eigine is working light or with no load, the ignition of the mixture may be certain to occur. It is therefore necessary that the combustion chamber be designed to provide as small a clearance space as possible, and, to do this, the air valve and exhaust valve are mounted one above the other upon the same vertical axis, the air valve being uppermost, being seated and guided in a removable cage, so that, when the latter is removed, the head of the exhaust valve can pass through the opening.

The sparking plug is fitted at the side of the combustion chamber in a mid position between the 3 valve heads, and at the back of the engine a fourth opening is arranged for the compressed air starting valve, while a fifth opening branches off at an angle for indicating purposes. All these openings, of course, have reference to the internal cylinder wall. The outer wall, which forms a water-jacket, has a similar number of openings, but, with the addition of 2 apertures for the entry and exit of the cooling water, as well as 2 others for the inlet of gas and air by separate pipes.

The cooling water enters near the exhaust valve seat, so that the coldest water cools the walls subjected to the greatest heat. Flowing round the breech end, it passes through small tubes communicating with the jacket round the cylinder casing. The tubes fit into cored holes, and are made water tight by rubber rings, thus preventing the water from coming into contact with any asbestos or other jointing material between the flanges of the breech end and main casting.

Governing

As already mentioned, the gas and air are brought to the engine by separate pipes, means of regulation being provided at both for the proper adjustment of the mixture to suit 2 kinds of power gas. Figure 1 shows a section of the Tangye breech casting, and it will be seen that the gas valve and main inlet valve are mounted upon the same spindle, so that the one movement controls the admission of both air and gas to form the working charge. The gas valve, however, is provided with an auxiliary spring so as to insure the proper seating of the upper valve by allowing for expansion of the spindle due to working temperatures. The variable lift of the end valve spindle is obtained in the manner depicted in Fig. 2. The rod, 5, always receives a constant motion from the admission cam on the side-shaft, but the intermediate link, 11, slides

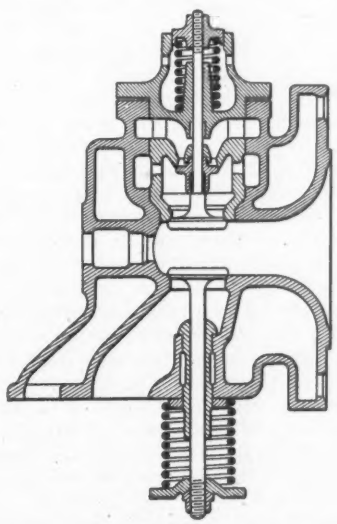


FIG. 1. SECTIONAL VIEW OF TANGYE GAS ENGINE BREECH CASTING

backward and forward, turning upon the fulcrum, 14, the necessary horizontal motion to effect this being provided by the levers, 15, 16 and 18, connected to the governor. It will be seen that, when the governor tends to rotate at higher speeds, the link, 11, is brought over, so that its relative position with 3 is such that only a minimum opening is given to the inlet valve spindle, while, under full loads, when the governor tends to lag behind, the link, 11, moves in the reverse

direction, giving an increased lift to the valves, and permitting a larger volume to enter the cylinder.

Owing to the attention that has been given to this method of governing by European makers, the number of devices that can be used for this purpose is now limited on account of the difficulty experienced in evading prior patents. Some of the mechanism that has been brought out for the purpose is extremely interesting, but no space can be given to this subject in the present article.

Lubrication

Special attention has been given to all details of lubrication. For the cylinder, a positively operated plunger pump is used, delivering oil to a light feeding device, by means of which the attendant can, at any moment, see that the engine is receiving the

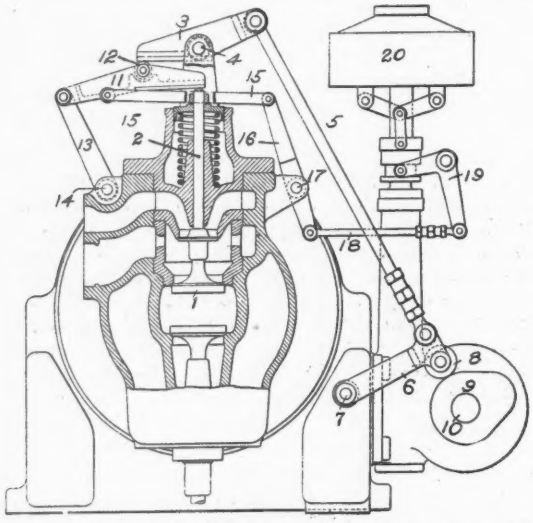


FIG. 2. VALVE MECHANISM OF THE TANGYE GAS ENGINE

proper amount of lubricant, while the quantity may be adjusted to avoid excess on the one hand and insufficient quantity on the other, in a manner which permits of much closer regulation than has hitherto been possible. The form of sight-feeding lubricator adopted by Tangye is one that permits the oil, in case of need, to be pumped directly into the cylinder instead of passing through the sight-feed glass, and thus it is not necessary to stop the engine should anything interfere with the visible feed portion.

For the piston pin, a separate visible feed lubricator is provided. A tube, conducting the oil to a small roller, which lightly bears upon 2 wiping contacts projecting from the front edge of the piston in such a manner that, as the oil collects, in drops, upon the base of the roller, the wipers remove the oil and conduct it by a tube fixed within the piston directly over the small end bearing. In this manner, the oiling of the piston pin is no longer left to chance, and it is found that the bearing gives much less trouble and requires adjustment much less frequently. The main bearings are fitted with oiling rings which rotate with the shaft and dip into a bath of oil formed below the bearing, and insures that the shaft receives a copious supply all the time the engine is at work. A sight-glass indicating the level of the oil in the reservoir is provided, together with a draining tube and plug fitted to a cover, which, when removed, discloses a hole sufficiently large for the insertion of a hand to clean out the bearing when necessary.

The crank-shaft is made of forged steel with the throw cut out from the solid forging supported by 2 bearings upon the engine frame and an outer bearing. The flywheel being placed between the latter and the main casting upon a strengthened portion which is of sufficient length to receive a driving pulley. Oil throwing rings are turned solid upon the shaft, so that creeping of the oil along the shaft is entirely prevented, all oil being thrown off by the rings within a projecting lip, which conducts the oil back into the main reservoirs. The bearing caps are fitted with lips to prevent any possible binding or imperfect alignment.

Starting

The Tangye compressed air starting valve also is of novel design and is shown in Fig. 3. The move-

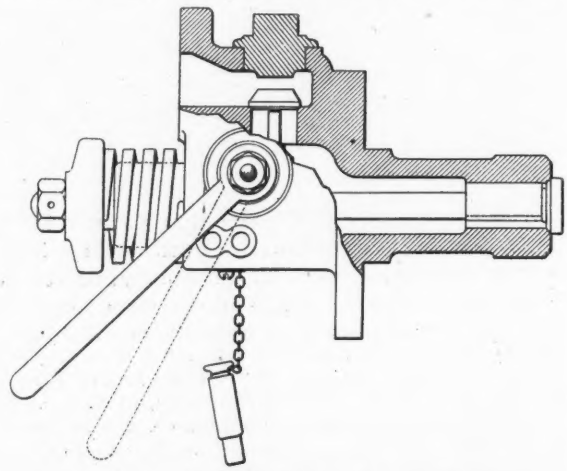


FIG. 3. COMPRESSED-AIR STARTING VALVE

ment of 1 hand-lever to various positions, acts as a relief valve for pulling round the engine to get it into position, also as a compressed air starter, as well as a charging valve, so that the engine may be used as an air-pump to refill the receivers, while a plug is also provided to permit introduction of benzine or gasoline for starting purposes should the air reservoirs be out of commission.

Generally

All the fulcrum pins for the various valve levers are well supported and of ample diameter and length for their respective duties. The only lever that is not supported on both sides being that for the exhaust valve, but it has been thought preferable to allow ample pin diameter to give great rigidity to the overhanging portion, rather than to provide a third bearing for the cam-shaft, which would then of necessity have to be supported from the breech end casting, which it has been one of the objects of the designers to render unnecessary. All the springs used in the engine are arranged to be under compression and are easily removable, provision being made for contact screws to retain the springs under compression to permit ready removal and replacement of the valves for cleaning or inspection.

It will be clear from this brief description that the new Tangye model is a great advance upon former practice, and the results achieved in operation after many months have proved well all that the makers have claimed. The engine runs smoothly and steadily, so that it is possible to balance a coin upon its edge while full load is being carried, a test which

has hitherto been possible only with some steam engines. Indeed, its similarity to steam engine, as far as working is concerned, is well marked, there being no noise or violent shocks that have hitherto been looked upon as a necessary accompaniment of industrial gas engines.

THE DEVELOPMENT OF THE GAS TURBINE

By A. S. Atkinson

THE development of the gas turbine, like that of the steam turbine and the producer gas plant, has been obstructed by a number of difficulties that a few years ago seemed insurmountable, but which have gradually yielded to the persistent efforts of investigators. For several years now gas turbines of various types have been in successful operation for experimental purposes, and the report now that a French company is ready to put a new type of engine on the market is of special interest to the engineering world. The Armengaud-Lemale gas turbine has undergone many changes since it was first put in the shops of the Societe des Turbomoteurs of Paris, and in its perfected form it indicates the near approach of the time when the gas turbine may take its place alongside of the steam turbine and the gas producer in the industrial world.

The original gas turbine used for these French experimental purposes was a modified 25-hp. De Laval steam engine, with the combustion chamber lined with refractory material that could withstand a temperature of 3,272 deg. F. But it was important that such a high temperature in the turbine should be materially reduced, and to accomplish this a spiral tube was inserted in the combustion chamber through which cooling water was allowed to flow. The steam generated in this way was allowed to mingle with the gases to make a further reduction in the temperature. In fact, this method succeeded in reducing the temperature to something like 752 deg. F.

The question of high temperatures in the gas turbine has always appeared the most difficult to overcome. In reciprocating internal-combustion engines the high temperatures are only periodic, and as a result the combustion chamber never attains an extra high temperature. The gas turbine on the other hand must stand continuously high temperatures and pressures. It is this continuity which makes these high temperatures so difficult to handle. Fire clay is an unsatisfactory material for a refractory lining of the com bustion chamber, and while magnesia and kieselguhr are found superior to fire clay they deteriorate with time and shrink largely. Carborundum so far has given the best satisfaction for linings. In the tests the best satisfaction has been obtained by using carborundum for the inner lining and surrounding this with magnesia or similar material. In this way the relative expansion of the shell and the inner lining of carborundum is provided for, and combustion chambers thus constructed have withstood temperatures as high as 4,000 to 5,000 deg. F.

But the maximum practical temperature to be allowed in the turbine should be nothing like this. While some authorities limit this temperature to 600 to 800 deg. others admit a maximum of 1,300 deg.; but in the French experiments with their modified De Laval gas turbine temperatures before and after reaching the nozzles were 3,270 and 750 deg.

The successful gas turbine must combine many of the virtues of the gas engine and of the steam turbine. In the attempt to solve the problem investigators have considered hot-air turbines, explosion turbines and combustion turbines. The French workers in this field dismissed the hot-air turbines as offering little advantage over any of the present form of engines, and confined their attentions to the explosion and combustion turbines.

The latter type is now admitted as the most satisfactory, for in the explosion turbines there is an enormous loss of power. It is impossible to realize more than a small percentage of the energy of the jet upon the wheel, making the theoretical efficiency of the machinery 16 per cent and the actual not more than 3 or 4 per cent. In the combustion type of turbine, however, there is a continuous supply of fresh compressed air and liquid fuel furnished in an uninterrupted stream, and this mixture is ignited at the start. A separate air-compressor is used instead of the air being compressed by the motor. In such a type of gas turbine all the products of combustion are utilized.

The difficulties in the way of securing such results, besides the question of injuring the parts by the high temperatures mentioned are the obstacles in the way of keeping the gaseous fluid moving at a high velocity in constant ignition and also giving as perfect a mixture of combustible material of air and gas.

In the French gas turbines it has been demonstrated that it is quite possible to maintain the combustion chamber holding high temperatures without injuring the linings, and that a complete combustion of the fuel could be obtained. From this turbine an efficiency of 60 per cent was obtained for the motor and 80 per cent for the compressor, giving an efficiency of 18 per cent for the whole machine. The combustion chamber is of cast iron lined with carborundum, and the nozzles are surrounded by a jacket space in which steam and water circulate. The wheel is cooled by water circulating through radial and rim passages.

In this type of gas turbine the gasoline or other liquid is delivered into the combustion chamber through an atomizer, and ignition is obtained through a coil of incandescent platinum wire. A speed of 4,000 revolutions per minute has been obtained with this turbine. The regulation of the speed is produced by a throttling valve and by a change in the fuel supply. This type of gas turbine requires the operation of 3 separate pumps, 1 for the air compressor, 1 for the fuel and 1 for the circulation of the cooling water. The depreciation of the parts of such a turbine must of necessity be considerable, but the work of decreasing this must come through later improvements. The chief thing to be noted is that the gas turbine has actually been made which will run successfully and show a good deal of efficiency and low waste of energy.

A number of patents have been taken out in this country and the several European countries governing the regulation of the gases and the temperatures for gas turbines. These several devices have accomplished a good deal in the general solution of the problem, and engineers of the different countries are not yet agreed upon the ultimate value of each one.

In England a patent taken out attempts to reduce the corrosion of the high pressure blades by the hot products of combustion through cooling the gases by a water jacket during their passage through a nozzle of peculiar design. This cooling device is located between the combustion chamber and the working cylinder. The object of this is to converge the gases into a funnel and thus secure their automatic compression at the same time that the temperature is reduced.

Another patent essays to evaporate water by the heat of the exhaust gases in a separate boiler and inject the steam thus formed into the mixing chamber. The difficulties in the way of this device are that the steam must be admitted at a higher pressure than that existing in the mixing chamber, and besides it would take a good deal of steam to cause any appreciable reduction of the temperatures. The loss of power in this way would naturally be considerable.

A British patent covers a system of projecting steam and gas through separate nozzles on to the buckets of an impulse wheel so that these buckets pass rapidly through alternations of temperature. The effect of this rapid change of temperature upon the buckets is a matter that has not yet been tested or worked out, but that it would be considerable is evident. It would be necessary in such a type of motor to keep the steam and gas jets absolutely separated or otherwise their mingling would neutralize the temperatures and after the engine had been running a short time high temperatures would prevail throughout.

An American type of gas turbine is quite different from any of those described. In this system the gas turbine is of the radial expansion type with an automobile boiler located above capable of supplying the turbine below at full load. The cylinders of a four-cylinder gas engine of standard type are used for the compression and combustion chambers, and the 2 exhaust valves are connected and open into a passage leading directly to the turbine. Steam from the boiler above is also injected into this passage to form a complete mixing of the gases before they are delivered to the turbine. An auxiliary exhaust also opens to the atmosphere. At each stroke the ignition of the gases causes the pressure to rise until the exhaust valve opens and delivers the products of combustion into the turbine. But before it is thus delivered it is mingled with the steam from the boiler which insures perfect dryness and a lower temperature. The auxiliary exhaust valve opens at 4/5 of the stroke and completely ejects the burnt gases. There is a certain amount of back pressure here, but it does not amount to much, and when the turbine is running rapidly the exhaust is practically a continuous stream of hot gases mingling with the steam.

This type of motor is not distinctly a gas turbine, but a combination of the ordinary reciprocating gas engine and turbine, but it is a type which has fundamental improvements as the heat loss to the water jacket and the heat lost in the exhaust are both fairly well eliminated. This type is considered promising for large units, but not for small ones. Marine engineers have been working on engines of this general type for some time, and it might in time be adapted to small boats and launches.

The steam turbine was half a century behind the water turbine in its development, and apparently the gas turbine is a decade or 2 behind the reciprocating gas engine. The difficulty in the way of the steam turbine was that the velocity of the expanding steam was too great to be used economically, and it was only after much experimenting that it was at all possible to handle this great velocity without losing energy or wearing out the parts too rapidly.

These difficulties are even greater in the gas turbine. When finally perfected it may not be a simple machine, and the need of many auxiliaries may, in the end, overcome all the gain obtained. Nevertheless, it is possible to devise a producer gas turbine that may be practical for stationary power generation on a large scale. It may even be possible to adapt such a turbine to automobile propulsion where a continuous combustion of gases will drive a wheel or shaft at great velocity, thus assuring a speed which will exceed all present ones.

One method advocated to achieve this result is to apply the same principles of the steam turbine to the gas turbine in having the gases pass through several stages with intermediate chambers. The combustion chamber would then be connected to one stage chamber after another, and as fast as it is connected with a new chamber the old one is cut off. A 2-stage turbine would then have 3 combustion chambers of which, at any given moment, one could be connected to the blower, one to the high pressure end of the turbine case, and one to the intermediate stage chamber. There would be certain oscillations in the turbine case with every explosion, but these would decrease with more numerous chambers.

The life of a machine in operation is just as important as its efficiency and cost of working and installation, and the question of the life of the perfected turbine is one that must be considered in relation to its other good qualities. It is true that the highest efficiency and most economical working of any machine cannot be considered entirely independent of the necessary auxiliaries required to control its different parts, but the gas turbine as constructed in the experimental stage to-day contains far more of these parts than the ordinary reciprocating machine. The reciprocating gas engine is simplicity itself, and it is this simplicity which has partly gained for it so many friends. It has fewer moving parts to get out of order than any other engine, and there is consequently less depreciation and high cost of maintenance.

The gas turbine is quite different. It must have more working parts and more auxiliaries, and these must all add so many more points of weakness. The steam turbine consisting often of millions of small separate parts offers this same disadvantage, but in the case of the gas turbine there must be added the great destructive action to these many parts due to the presence of exceedingly high temperatures. If the perfected gas turbine could be operated to-day at ⅓ the cost of the reciprocating engine it is not entirely clear that it would make a saving in the course of 5 or 10 yr. If the depreciation should advance so fast that its life was only ⅓ or ½ that of the ordinary gas engine the gain in efficiency would be a little doubtful. It is this question which makes some of our best engineers question the future value of this prime mover. On the other hand almost similar difficulties were encountered a short time ago in developing the steam turbine, and they were all successfully overcome. If the same becomes true of the gas turbine we may soon find this prime mover in the market making a strong bid for adoption.

"A BOOK IS A SPEAKER; reading is listening. How you read is as important as what you read. Reading which neither gives information nor power, that is material for thought or inspiration to thought is useless."—Abbott.

REFRIGERATION PLANT AT MONMOUTH

ICE MAKING SUPPLEMENTARY TO LIGHT, HEAT AND POWER

EFFICIENT power plant operation depends largely upon the ability of the management to keep the employees and all apparatus working at full capacity all the time. In some small cities the demand for electric light and power is not sufficient to make the plant for that particular service a profitable investment and by adding to the equipment of the plant machinery for exhaust steam heating or the manufacture of ice, the plant may be run economically and profitably throughout the entire year with little outlay of capital.

This plan is well illustrated in the plant of the Searles Power Co. of Monmouth, Ill., which has recently installed an ice plant and is now fully equipped to furnish light, heat, power and refrigeration.

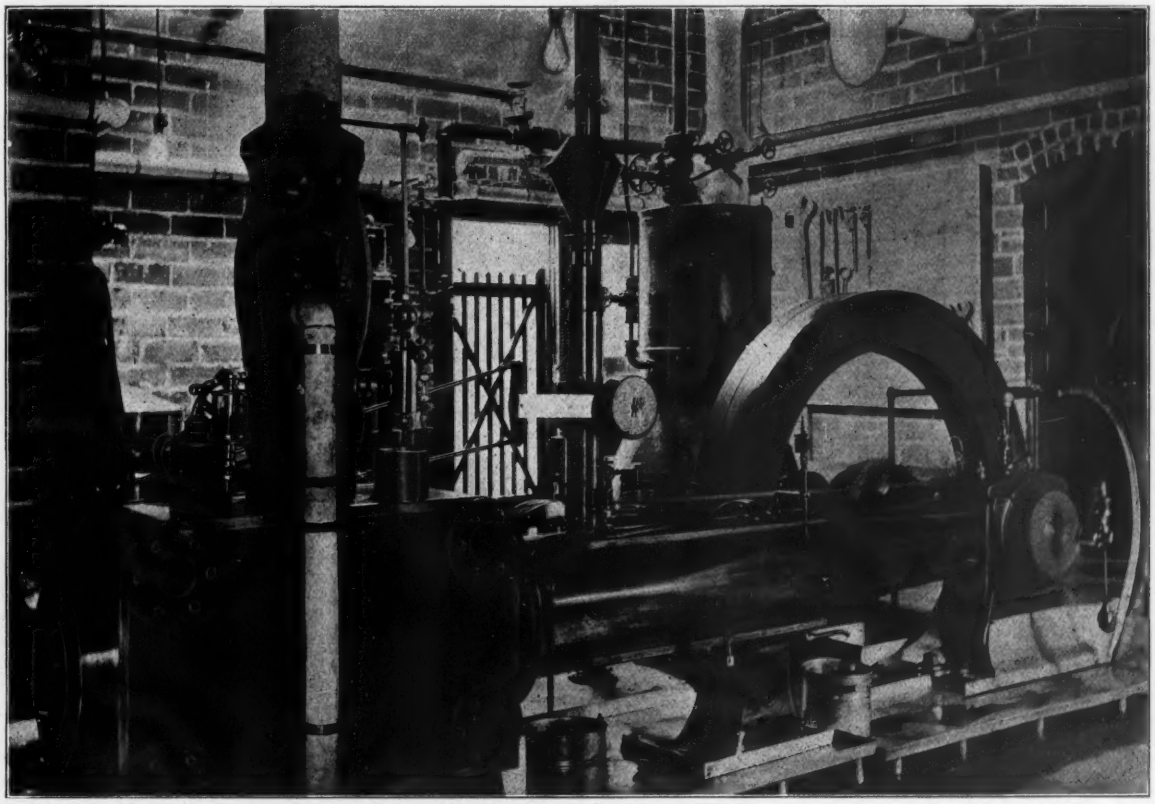


FIG. I. ENGINE ROOM OF THE SEARLES POWER CO. ICE PLANT

Boiler Room

All the steam used in the plant is generated in 1 boiler room equipped with 2 100-hp. boilers. These are of the Erie make, and the return tubular type being 66-in. in diameter, by 16 ft. long, containing 64 4-in. flues. Each boiler is equipped with a Diamond flue blower and the gases are conducted through a common breaching to a metal stack 65 ft. high by 4 ft. in diameter.

Engine Rooms

The engine room of the old plant is equipped with a 12 by 12-in. Erie engine, running at 280 r. p. m., direct connected to a Keystone generator, which delivers direct current at 220 volts, and has a capacity of 60 kw. In this room is also located a Webster exhaust steam feed water heater and necessary apparatus for the heating of office buildings by the Webster system.

The refrigeration plant is joined to the rear of the power plant and consists of an engine room, freezing room, and ice storage. In the engine room, Fig. 1, is located a Murray Corliss engine, 11 by 24 in., running at 95 r: p. m. supplied with steam at 100 lb. pressure through a 4-in. steam pipe, in which is placed an Austin steam separator, this being drained by a Wright Emergency trap. The exhaust from the engine is a 4.5-in. pipe, and as the exhaust steam is used in the manufacture of the ice, it is passed through an oil separator.

Direct connected to the engine is a Larson & Baker ammonia compressor, 9.5 by 14 in., rated at 25 tons refrigeration per 24 hr. The pressure maintained in the expansion coils is from 10 to 15 lb., while the discharge from the compressor is about 180 lb. per sq. in. The suction line is equipped with a scale trap which removes all solid and liquid matter from the gas, and an oil separator is placed in the discharge to catch the cylinder oil used in the compressor.

Water Supply

All. water used in the station is supplied from 2

wells, 230 ft. deep, from which it is pumped by 2 5 by 24-in. deep well steam pumps, made by the American Well Works. These pumps discharge into a concrete reservoir, placed underneath the ground, with a capacity of 480 barrels. The temperature of the water coming from the well is 51 deg. F.

There also is located in this engine room, an air compressor made by the Curtis Co., 4.5 by 4.5 in., running at 100 r. p. m., and delivering air at 80 lb. pressure, which is used to drive the crane. This compressor is driven by a belt from a Keystone motor of 4.5

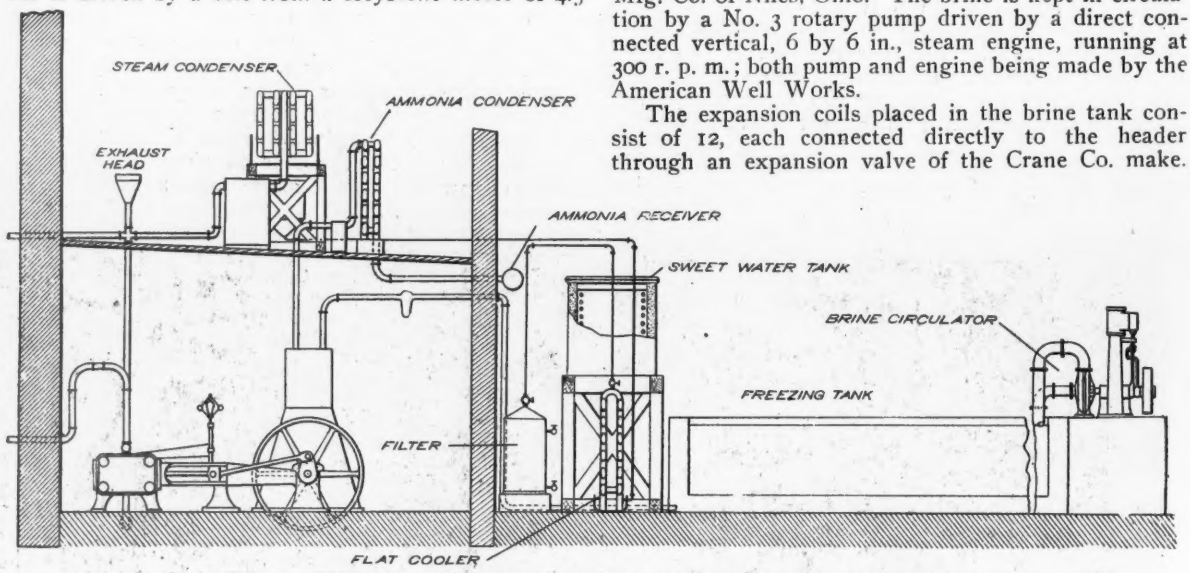


FIG. 2. ELEVATION OF PLANT SHOWING ARRANGEMENT OF APPARATUS

kw. capacity, which requires direct current at 220 volts. The discharge pressure of the compressor is automatically maintained by a device which holds the suction valve raised when the pressure is above 80 lb.

Condensing Equipment

All the steam and ammonia condensing apparatus is located upon the roof of the engine room, and is shown in Fig. 3. Exhaust steam from both engines is lead to an oil separator, 35 in. by 5 ft., made by Wishart-Burge Machine Works, and containing a series of 6 baffle plates. It is equipped with an exhaust back pressure valve, between it and the engines to prevent the exhaust condensation from backing up into the cylinders. Steam not used in the ice process is discharged through a Burt exhaust head.

Compressed ammonia gas is conducted through an oil separator to an ammonia condenser, which was made by the Larson & Baker Co., and consists of a double pipe system in 2 sections 20.5 ft. long. From the ammonia condenser the ammonia is conducted to a receiver, 8 in. by 18.5 ft., which is located in the freezing room, and is then piped to the header, from which it goes to the expansion coils.

Water used in cooling the ammonia, exhaust steam and sweet water is pumped from the reservoir by a Buffalo duplex steam pump, 5.5 by 3.5 by 6 in., placed in the old engine room, the discharge line of which is divided, one pipe going to the flat coolers, the water being caught and returned to the reservoir. The other line conducts the water through the double pipe ammonia condenser, thence over the steam condenser. The steam condenser is placed inside a pan, which catches the cooling water, and from which the water is conducted to a charcoal filter which removes scale forming material. From there it is piped to a Webster exhaust heater and used as feed water for the boilers.

Freezing Room

Ice making is done on the indirect system, calcium chloride brine being the conveying liquid. The freezing tank is 16 by 37 ft., with a partition running the entire length, and gives sufficient room for 192 cans, 11 by 22 by 44 in., each having a capacity of 300 lb. These cans were made by the Ohio Galvanized Iron Mfg. Co. of Niles, Ohio. The brine is kept in circulation by a No. 3 rotary pump driven by a direct connected vertical, 6 by 6 in., steam engine, running at 300 r. p. m.; both pump and engine being made by the American Well Works.

The expansion coils placed in the brine tank consist of 12, each connected directly to the header through an expansion valve of the Crane Co. make. The length of pipes is such that there are 320 linear ft. to 1 ton of refrigeration per 24 hr.

Condensing and Freezing Process

From the oil separator exhaust steam is conducted to a steam condenser of Wishart-Burge Machine

FIG. 3. STEAM AND AMMONIA CONDENSERS

Works make, which consists of 4 sections of 2-in. pipe, 5 pipes high, cooled by water flowing over their surfaces.

After the exhaust steam has been condensed, it flows to a reboiler, 28 in. in diameter by 36 in. deep, which is equipped with an oil separator and automatic regulating device. The water is then conducted to the flat cooler, located in the freezing room, which con-

sists of 2 coils 20 ft. long by 12 pipes high, made of 2-in. galvanized iron pipe, over the surface of which cooling water flows. The coils are placed in a pan 22 ft. by 18 in. by 12 in., which catches the cooling water and delivers it to the reservoir.

The sweet water is then conducted to 2 charcoal filters, each 30 in. in diameter by 6 ft. deep, which are piped in such a way that the water can be passed through them either in series, parallel or separately. The water is then discharged into the sweet water tank, 30 in. in diameter by 6 ft. deep, which is equipped with direct expansion cooling coils. The ratio of 10 linear ft. of pipe to the ton of rating of the plant, is employed. From the sweet-water tank, the water is

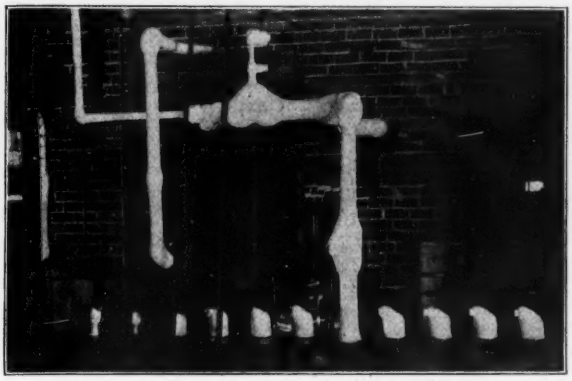


FIG. 4. VIEW OF FREEZING ROOM SHOWING FILTERS, SWEET-WATER TANK, AMMONIA RECEIVER AND EXPANSION VALVES

delivered at 34 deg. F. through a No. 3 International filter to a Burns automatic can filler, thence into the cans.

The freezing room is equipped with a Curtis crane which is capable of drawing 3 cans of ice at one lift, and is operated by compressed air. The cans of ice are delivered to the can dump, which after the cans have been warmed by a flow of hot water over the surface,

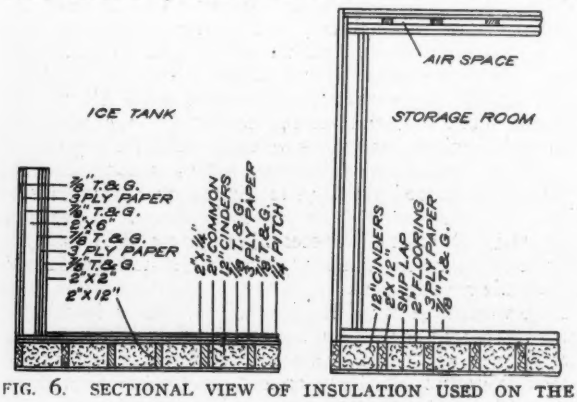


FIG. 6. SECTIONAL VIEW OF INSULATION USED ON THE FREEZING TANK AND STORAGE ROOM

discharge the ice directly to the storage room. The ice storage room is 15 by 15 by 46 ft., which gives it a capacity of 125 tons of ice. The room is kept cool by direct expansion ammonia coils in the proportion of 1 linear ft. to 3 cu. ft. of cooling space. All of the doors which enter this cooling room were made by the Jones Cold Store Door Co. and which thoroughly insulate the room from outside temperature influences.

The ice doors are of a patent design, made to accommodate 3 blocks at a time and automatically record each block of ice as it passes from the ice storage room.

The Wishart-Burge Machine Works of Chicago did the consulting engineering and construction work of this plant, and Nels Jessen is chief engineer, who feels justly proud of his well equipped plant.

OPERATING COST OF AN ICE PLANT

IN a paper before the Indiana Ice Manufacturers' Association, Clay Whiteley gives a set of interesting figures which are worth studying and comparison with actual performance in one's own plant. He first

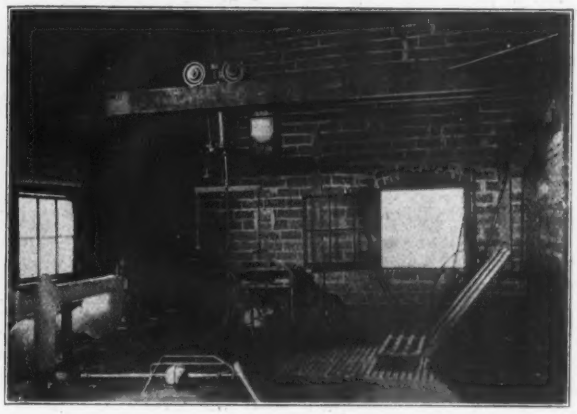


FIG. 5. BRINE CIRCULATOR AND ICE-HANDLING APPARATUS IN FREEZING ROOM

states as the cost of plant, stables, teams, etc.—a complete outfit ready to do business—of 40 tons capacity, $40,000, and interest at 6 per cent. Yearly costs are then given as: Interest, $2,400; taxes, $360; insurance, $175; water, $28; salt, $40; ammonia, $193; oil and paint, $142; packing, $48; telephone and telegraph, $103; coupon books, $110; postage, $23; stationery, $60; miscellaneous, $267; repairs and replacing, $865; day engineer, $1,140; night engineer, $450; day ice puller, $650; night ice puller, $325; bookkeeper, $1,020. This gives a total of $8,399 a year for making 7,020 tons of ice, to which is added cost of fuel and firing $3,886, and cost of delivering $5,054.40, making a grand total of $17,339.40, or $2.47 a ton.

Depreciation must be added at say 5 to 10 per cent. or say 30c a ton, making $2.77 a ton as cost price.

Speaking of the matter of fuel, which, as shown by the above figures, is a considerable part of the entire cost, he said:

"The most economical coal to purchase is not the cheapest, yet some can use a cheap coal. The draught through their furnace is good, and they have plenty of boiler capacity, and can use their coal on a very thin fire and not having to crowd the fire can use a cheaper grade of coal. The best coal containing the highest volatile and carbon properties and the lowest sulphur and ash, like most of our West Virginia splint coals, is the economical coal to use where the boiler capacity is limited, as these are free burners, consume the carbon quickly when fresh coal is thrown into the furnace that usually passes off through the smoke stack. The fires from such coal being very hot, the smoke largely consumed and much heat is secured.

"The best result is, of course, secured from thin firing, a thing that is very difficult to get from the average firemen. They want to fill up the furnace and

then retire to some good seat prepared for a long rest before they need to fill up again. This is all wrong if you can avoid it. We have had very fine results from a West Virginia coal from the Red Jacket mine. It is a rough looking coal, but is a fine steam producing coal with little ash and I know of a number of ice plants that are using this coal. If Indiana coals are to be used, the Linton No. 4 stands at or near the top of the list. I am a crank on thin firing and was always of the opinion that stokers should be used to put coal in a furnace.

"Now, gentlemen, it resolves itself down to this: Each manufacturer must with his engineer make a study of his own plant as to the way to get the best results from coal. It will pay every coal user to get shaker grates. There are several good ones in the market. Then get a good steam flue blower that blows the flues from the rear end with the draught of the boiler. We use the Diamond flue blower and have never seen any that was better.

"When in Paris, France, attending the World's Refrigerating Convention, I went out to see how the fuel was handled at the electric light plant that furnishes most of, or a large part of the electricity for the city of Paris. A boat load of coal was moored to the dock of the plant on the River Seine and a steam shovel was taking out the coal and dumping it on the endless steel belt conveyor that carried it obout 150 feet and dumped into a hopper that had a conveyor with pockets that carried the coal up about 40 feet and was again dumped on another conveyor that took it about 100 yards and dumped it in a large hopper over the steam boilers and the coal fed down by gravitation onto the stokers which carried it through the furnace and dumped the ashes below into another hopper that deposited them into the pockets of an endless steel belt that carried the ashes out and dumped them onto the boat to be hauled away."

ICE PLANT QUERIES

Our plant has a machine of 500 lb. capacity in 24 hr.—a baby plant—compression system, motor-driven, and we have trouble to keep the suction pressure where it belongs.

1. Would taking out one-quarter of the ice and filling the cans with water effect the suction pressure? If so should the expansion valve be readjusted?

2. Would a wide variation in suction pressure indicate a clog in the suction valve?

3. Should there be a difference of temperature between top and bottom of brine tank as great as from 10 to 15 deg. F. after pulling one-quarter of the ice if the machine is working properly?

4. Would taking all of the ice out of the tank at once affect the capacity of the machine?

5. How can one free the system of oil, scale and other impurities without wasting ammonia?

A. Compression machines of the type you mention are equipped with either automatic or hand expansion valves. A properly designed automatic expansion valve should maintain a constant suction pressure regardless of the temperature in the tanks. If the machine is equipped with a hand expansion valve it is advisable, for the sake of economy, to increase the suction pressure by increasing the feed when the tanks or rooms to be cooled are at a high temperature.

Getting Good Economy

This increases the load on the motor but not in proportion to the work accomplished. In other words, conditions for maximum of economy are that the suction pressure be carried as high as possible without frosting back to the machine sufficiently to cause the machine to pound or to cool the stuffing box to such an extent as to allow leakage of ammonia.

The more ice you take out at a given time, the higher suction pressure you will be able to carry without freezing back to the compressor and the more ice you will get per kilowatt expended in the motor as well as per hour of run of the machine. While the pulling of ice in these machines is more a matter of convenience than of efficiency, we are inclined to think that by pulling a given quantity at a regular interval, the condition which is urgently insisted upon in the operation of our commercial ice plants, the less difficulty you will have in keeping the expansion valve properly adjusted, and the less attention your machine will require in general.

In these small machines, especially if there is no agitator in the freezing tank, the temperature of the brine may easily vary as much as from 10 to 15 deg. after pulling one-quarter of the ice.

Ammonia Shortage

You evidently mistrust that your machine is not working up to its full capacity, and our experience leads us to suggest that if such is the case, and you do not have knowledge to the contrary, it is more than likely due to a shortage of ammonia. The machine should always contain sufficient ammonia so that there will be no passage of gaseous ammonia through the expansion valve. This can usually be recognized by intermittent whistling of the gas in passing through the restricted opening at the valve.

Removing Impurities

There is no effective way of getting oil or other foreign substances out of the refrigerating system without losing more or less ammonia. This applies to the machine of large as well as small capacity. You should, however, proceed as follows:

Close the expansion valve to the freezing tank and allow the machine to operate until the suction pressure comes down to a vacuum. Shut the machine down for a short time and see whether the suction pressure again rises; if so let it run a few minutes longer until the pressure is again reduced to a vacuum, this may have to be repeated several times. When the suction pressure no longer rises after shutting down the machine, you should be reasonably sure that most of the ammonia has been evaporated in the freezing coils and passed through into the condenser and receiver.

This having been accomplished all the valves should be closed tightly "locking" the ammonia into the "high-pressure" side, after which you can disconnect the coils in the freezing tank and clean them by blowing out, with air or steam, or, if neither is available, the greater per cent of the oil can be dislodged by simply heating the coils.

If there appears to be graphite or other foreign substance in the coils, this can be dislodged by kerosene, after which the kerosene should be cleaned out as well as possible and the coils are then ready to be reinstalled in the freezing tank.

In connecting up the coils, the flange nearest the expansion valve should be left loose so that when the suction valve of the machine is opened, allowing the gaseous ammonia to return to the expansion coils, this ammonia will sweep the air before it and expel it through the flange. When gaseous ammonia appears at this point, the flange may be tightened up and the machine put in operation as usual.

F. E. Matthews.

I am operating a 1-ton Remington ice machine, which I erected about 8 months ago. It has been running nicely and doing good work until 2 weeks ago, when it suddenly fell off. I found I had a lot of foul gas in the system. I got rid of this and put a new charge of ammonia in, but it don't work efficiently on the brine tank although it works splendidly on a refrigerating room which we have for meat. Could you give me any information as to the reason for this? I may state I tested the plant up to 300 lb. pressure and pumped it down to a vacuum of 28 in. before charging.

A. The letter is not explicit enough to form exact conclusions, but presuming that the liquid anhydrous is the same as usual, that the refrigerating room is operated by direct expansion, that the brine tank is for ice-making, and that there were no changes or alterations made either in the operation of the machine or otherwise, it would indicate an obstruction in the expansion valve, or the pipes leading to the freezing tank coils, or in one or more of the coils.

To determine this, note the difference in the frost on the pipes leading to the refrigerating room and the brine tank; if both are frosted about the same, then the trouble is in the brine coils, and by opening the expansion valve wide, for say a minute or so, the obstruction can sometimes be blown through the coils, taking care not to get the suction pressure too high. If, however, this does not answer, then the only way is to disconnect the tank coils top and bottom, attach an air pump to the suction side and force the obstruction out at the same end where it entered. Should there be no air pump, use the brine pump and afterward allow the pipes to drain well before reconnecting.

If the expansion valve is at fault, opening it wide quickly will almost invariably clear it. It is also possible that the valve disc, if there is one, may be loose, and while indicating by the hand wheel or lever that the valve has its proper opening it practically has not by reason of the loose disc. Wm. S. Luckenbach.

FEED WATER SOFTENER FOR SMALL PLANT

By Edw. T. Binns

THE sketch herewith shows the plan for softening the feed water at the plant of Cope & Co., Wayne Junction, Philadelphia. Considerable trouble had been experienced with scale in the boilers caused by the hardness of the water. Since the installation of the present arrangement which was put in by the American Water Softener Co. conditions have been greatly improved.

The idea is to make the arrangement act automatically. In Fig. 1, G is the supply pipe and H is the discharge from the softening tanks. The supply or storage tank E is provided with a float which regulates the admission valve in the supply line. In this line is placed an elbow and short nipple turning downward, which discharges into a rocking bucket F.

When 1 side of this bucket is full it tips over and empties, bringing the opposite side in position to be filled, there being a partition in the middle of the bucket which is extended up several inches, carrying a cam-shaped attachment which comes in contact with a similar cam at the highest part of its arc; this cam is connected to the bottom end of a rod, which operates a small valve in the bottom of the tank A. This tank contains the solution desired to soften the water; the chemicals, of course, can be varied as the case may require.

The water gushes through a series of settling and filtering tanks, which are kept warm by a pipe connection, not shown, from the exhaust steam of the engine. It is claimed that the separation of all foreign matter from the water is better accomplished by warming. Provision is made for draining all the tanks into the sewer when they are to be cleaned.

Another rather interesting feature about this plant is the installation of an exhaust injector which was

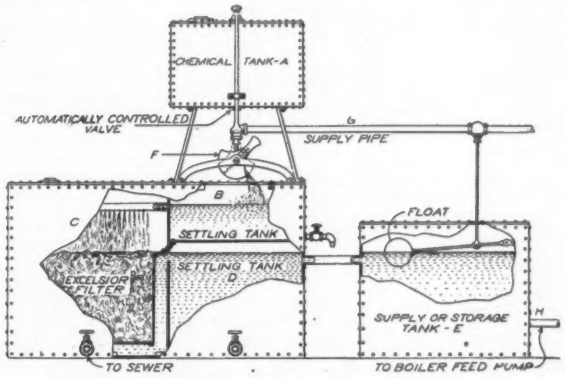


FIG. 1. ARRANGEMENT OF WATER SOFTENER

made by Schaeffer & Budenburg of New York. The injector is operated by the exhaust steam of the engine, discharging the feed water through a closed heater to the boilers. The engineer in charge stated that it would work with so little back pressure as not to show at all on the gage. From numerous experiments in changing over to the live steam injector

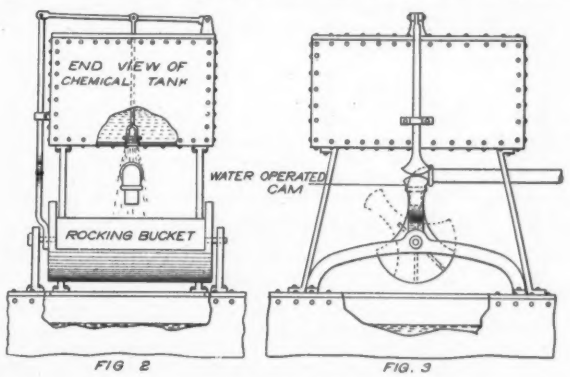


FIG. 2. SIDE VIEW OF CHEMICAL TANK
FIG. 3. DETAILS OF CAM FOR OPERATING VALVE

for a day it has been shown that they were saving about 50 per cent* of coal. No boiler feed pump is installed.

"A man was born, not for prosperity, but to suffer for the benefit of others, like the old rock maple, which, all round our villages, bleeds for the service of man."—Emerson.

"It is not by thinking or feeling, but by doing that we get the knowledge and the command of ourselves. But we must have thought to translate into action, and feeling to give us the impulse."

*The figure given here is that submitted by the author of the article and is published with some misgivings. Readers are invited to verify his results and submit the test data for publication. —Editors.

PRACTICAL ENGINEER

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SIZING THINGS UP

The difference between doing things any-way-to-get-there and doing them right is largely a matter of sizing things up. Some people—but they're few and far between—can plan as they go along. The rest of us need some definite time for planning work in order to do it to the best advantage. Such planning or sizing up is as much a part of work as driving nails or packing a joint.

To be an efficient chief requires regular systematic times for planning; when is a matter of convenience or preference to fit one's needs. The end of the day seems on many accounts the best time to size up what has been done and plan what needs be done on the morrow, but there are often things to be rushed through or overtime work on boilers and joints which make quitting time a bad season for quiet thinking. The next best time is early afternoon, which gives a chance to see what has been done so far and to push through, before night, work that needs doing. It all depends on the routine of the plant; but a regular sizing up, daily or weekly, of what needs attention in the plant, what to do first, how to go at it, where improvement may be made in routine or arrangement of equipment, is something which every man who has the management of men or of things owes to himself, his employers and his employes.

And when you're sizing up, look over the men as well as the plant; likely there is a chance to improve them by different treatment or discipline. It's part of a manager's business,—and every chief engineer is a manager,—to get the most out of his men and to get them to make the most of themselves.

Well, what if we are talking to the chief and you happen to be in the ranks. You want to be chief some day and you need to learn the job. The first step is to get the habit of sizing up your own work each day and managing yourself so as to get the most out of your abilities. No man ever did that by haphazard drifting along. He must continually size up the situation and himself.

Yes, this has all been said a hundred times before; probably better then it is said here. But are all you folks who read this putting the principle into practice? If you are not, then it needed to be said again. If you are, Practical Engineer readers have the best operated plants in the country.

EDUCATIONAL WORK

It takes a distinct effort to turn from pleasant amusement to the effort of acquiring knowledge. It's fun to do the studying and thinking and to gain conscious power, after you once start; but the start requires an effort. When at convention, it is harder still to turn from enjoyment to study, but the state conventions this year have shown the way to combine study and pleasure in most enjoyable lectures and, although the time is brief, there should be space for one superlatively good lecture at each national convention.

It is doubly unfortunate therefore when any circumstance lessens the effectiveness of a lecture, for the effort made has been lost and there is less inclination to make another effort. To get good results in such work, freedom from distracting influences is necessary and the best of conditions for both speaker and audience.

Why should the lecture be always on the engine or the boiler? An engineer is a man, and his range of interests includes recent progress in astronomy, physics, chemistry, railroading, flying,—things innumerable. One good lecture by a man of recognized ability and under conditions which ensure its success is well worth while as a part of every convention of engineers. It is to be hoped that no future convention will be considered complete without this feature and that as great care will be taken in providing for it as in arranging for exhibits or elections.

EDITORIAL CHAT

Elctricity in the Boiler

We have always been taught that we must prevent electric currents in our boilers or the bogy man would eat up the boilers by taking small nips here and there. Now comes a proposition to keep a good sized electric current flowing through the boiler in order to prevent the formation of scale, and so our old ideas have to go in the waste basket and we start all fresh.

In an article in the Engineering Review, F. A. Lart explains the setting up of current between the copper parts which may be in the boiler and the iron plates, the galvanic action which is familiar to every engineer. Mr. Lart advances the theory that the usual methods for preventing scale formation in boilers by making the water more or less alkaline instead of acid are successful because they make impossible the formation of electric currents between the water and the metallic parts of the boiler.

He furthermore claims that experiments which he has recently conducted prove that passing a current at low voltage from any ordinary primary battery through the structure of a working boiler and the water contained in it will entirely prevent the deposit of solid matter contained in the water in the form of hard scale. The particles will come down simply as mud, which may easily be blown out. The experiments were carried on with dry cells of 1.5 volts em. f. and no experiments at high voltage have yet been carried out.

With this theory properly demonstrated we shall then be forced, not to get rid of electric currents in our boilers, but to regulate them, and Mr. Lart allows that the proper method of electrical purification is to connect "the top and bottom sides and ends each and all, or such as the construction of the boiler may provide, well below the normal water level with one or more primary batteries, so that a continuous electric current will pass through the whole body of water longitudinally, transversely, and vertically, as far as possible." He would use as electrodes brass plugs tapped into the boiler shell and projecting well into the water so as to be well covered by it.

The experimenter saith not how he will prevent electric currents being set up in the boiler between the shell and the brass plugs which will cause pitting of the boiler shell, but it is probable that if a definite direction were given to the currents any small local circuits might be chased out and forced to discontinue business by the big general trust current, which was set up from the primary battery, and these aforesaid small currents which have played the part of the "ultimate consumer." of the boiler would, therefore, be put beyond the occasion for any consideration whatever.

Don't all hitch primary batteries onto your boilers at once. There may be a mistake somewhere.

FUEL FEEDING

All stoking may be subdivided into 2 classes, over-feed and under-feed.

The over-feed principle involves the feeding of green or uncoked fuel on top of the burning fuel.

What occurs with hand firing, or the over-feed principle, is that a heavy charge of green fuel is thrown on the fire through the furnace door. This is almost always in excess of the actual requirements, often carelessly and unevenly spread, and, of necessity, irregular. In addition, the cold air which is admitted through the furnace door impinges against the heated surfaces, lowers the temperature of the fire, and imperfect combustion and smoke result.

In stokers of the over-feed type, fuel is fed beneath coking arches or baffle tile to prevent the tubes from cooling the hot gases below the ignition temperature. Air is admitted under the coking arches with the fuel, and as combustion is dependent upon natural draft conditions, a large excess is usually provided.

The under-feed principle involves the feeding of green fuel beneath the coked and burning fuel. From this it will be seen that the incandescent fuel bed provides in itself an arch or baffle, which fulfills even more perfectly than the specially constructed arch and baffle, above mentioned, the functions required of them.

In this type, air may be supplied at the proper pressure and under mechanical control; in fact, the absolute control of the air, regardless of varying temperatures, leaky settings, obstructions in the flues, etc., makes possible complete combustion with the minimum supply of air at all times.

WE HAVE HEARD A LOT about animal magnetism and now comes along Dr. Andrew McConnell, of the Society of Universal Science, who claims that every man is a dynamo. He states that what we call life and life principle is simply a form of electricity generated in our bodies and applied and controlled by our wills. Dr. McConnell claims that the measure of each man's health and working power is the amount of electricity which he has in him and that this amount can be increased to any extent by the individual. Granting that this theory is true, all we need to know now is how to start the dynamo and get a bigger current. Then we shall all be prodigies and geniuses.

ELECTRICAL MACHINERY AND APPARATUS

ALTERNATING VERSUS DIRECT CURRENT—II

COMPARISON OF MOTORS

By Fred McNeill

UNDERLOAD induction motors and transformers are the chief cause of low power factors. The general characteristics of the induction motor as compared to the direct-current motor are shown in the curves, Figs. 3 and 4.

It will be noticed that the electrical efficiency of both machines is practically the same at, or near, full load; the direct-current machine showing a steadily increasing efficiency between full load and point of the maximum output, while the induction motor decreases rapidly with overloads. It will also be noticed that at no load the induction motor takes about ⅓ its full load current, showing a very low power factor at light loads, and a maximum of about 0.80.

Before going any further into comparisons, it may be well to study briefly the construction of the induction motor, and its theory.

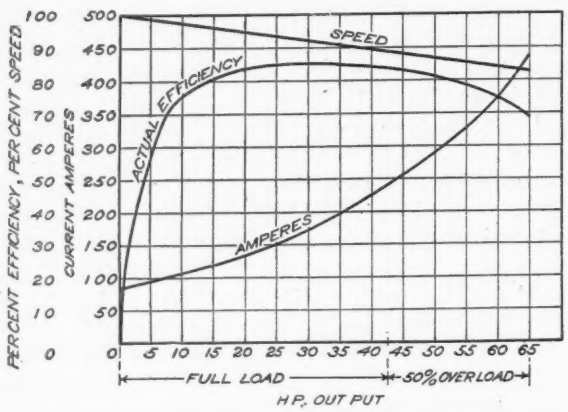


FIG. 3. RESULTS OF TESTS OF 3-PHASE INDUCTION MOTOR

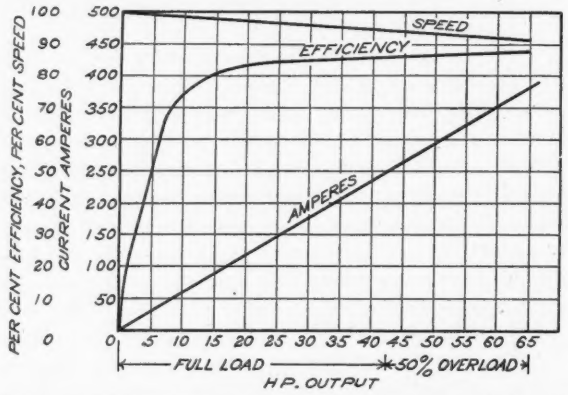


FIG. 4. PERFORMANCE OF DIRECT-CURRENT MOTOR ON TEST

Generation of E. M. F.

If a conductor carrying a current be placed in a magnetic field, that conductor will have a tendency to move at right angles to the lines of force, and with a force proportional to the current and field strength. If the conductor be moved, an e. m. f. will be generated in proportion to the field strength and the rapidity with which the conductor is moved, or the conductor may be held stationary and the lines of force moved with the same result.

It is not necessary to move the iron carrying the lines of force in order to move the lines themselves; varying the current by which the lines are originated will have the same effect.

A conductor in a field that suddenly becomes demagnetized, will have an e. m. f. generated in it just the same as if the conductor had been moved and, if the field is again magnetized, an e. m. f. would again be generated in the conductor, but in the opposite direction to that of the first instance. In this manner a complete cycle of alternating e. m. f. may be generated, the minimum values occurring when the field is fully magnetized and the maximum values when the magnetic change is the most rapid in passing through zero.

The Single-Phase Motor

Figures 5 to 8 will be used to illustrate the principle upon which the single-phase motor operates. N and S are iron cores wound with copper wire around which a current is passed in such a manner as to magnetize the cores in opposite directions. The lines of force thus generated, in passing from N pole to S pole must pass through the rotating part C, which is a laminated core, having straight copper conductors imbedded in it, the ends of all being connected together so that any current set up in a conductor may find a path from one end to the other.

If the poles N and S are magnetized suddenly, during the process of magnetization a current will be set up in the conductors, which reacts on the field in such a manner as to cause a tendency of the rotor to turn 180 deg. and present its opposite sides to the poles being magnetized; that is, those conductors and part of the rotor under pole N when the magnetic lines were changing, would be attracted to pole S, and in like manner the conductor under pole S would be attracted to pole N.

The force on the conductors to move the rotor or armature reverses so rapidly that there is not time to set up motion because of the weight of the parts. Also the pull on the core is straight across from one pole to the other, not rotary. An engine on dead center with steam alternately admitted from one side of the piston to the other would be analagous to this arrangement. If the engine were given a start, it would continue to turn and so will the single-phase motor of which the foregoing is a fair illustration.

The objections to the single-phase motor are obvious; it is not self-starting, and the torque, when

started by external means, is low, until the maximum speed is reached. There are, however, self-starting single-phase induction motors on the market and in fact in use for small power. A commutator and brushes are required, together with mechanism for throwing the brushes off the commutator when full speed is reached.

By substituting a 4-pole arrangement with polyphase winding in place of Fig. 5, as shown in Figs. 6, 7 and 8, we have an illustration of the directions taken by the lines of force in a polyphase induction motor, which is self-starting and may be caused to start in either direction, merely by interchanging any 2 of its supply wires.

As like poles of a magnet repel, and unlike poles attract each other, and as the current generated in the conductor of a rotor of an alternating-current induction motor, causes that part of the rotor to be of the same polarity as the pole it is under and opposite to

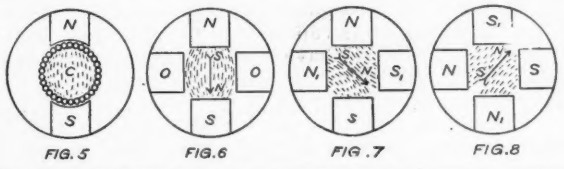


FIG. 5. DIAGRAM TO SHOW SINGLE-PHASE MOTOR ACTION
FIGS. 6 TO 8. DIAGRAMS SHOWING VARYING DIRECTION OF FIELD IN POLYPHASE MOTOR

the next adjacent one; that part of the rotor would therefore be repelled by the pole responsible for its current and attracted by the adjacent pole. As the rotor, as far as the principle is concerned, would act the same as a compass needle, the latter has been used in the illustrations, so that they may more readily be understood.

Suppose the poles N, S, N_1 and S_1, Figs. 7 and 8, be arranged so that each pair could be excited separately, the compass needle will take its position parallel to any lines of force that may be caused to flow as shown.

If the 2 sets of poles are excited by currents of the same strength as shown by Fig. 7, the needle will take its position half way between the pair of the same polarity.

Now if the pole S is becoming weaker and S_1 stronger, it will be obvious that the needle will turn to the latter until it reaches its maximum value, if the exciting current is alternating and the current around pole S_1 having reached its maximum value immediately begins to weaken and the other current not only having reversed its direction, but begun to grow stronger in that direction, the needle will again be attracted to the pole which is growing stronger. In this manner a continuous rotating motion will be obtained and the direction will be determined by the phase relation of the 2 currents.

Reversing any 2 of the exciting wires will obviously reverse the direction of rotation.

A steam engine having 2 cranks at right angles to each other is analagous to the action of a 2-phase motor; when 1 crank is on center, the other is exerting its maximum power to pull it off, and an engine having 3 cranks at 120 deg. bears the same relation to the 3-phase motor which depends on the same principle for its operation.

Properties of the Induction Motor

The efficiency of the induction motor depends largely upon the air gap between its rotating and stationary parts, and manufacturers make this air gap as small as they possibly can and still have their bearings run a reasonable length of time without renewal.

This feature is a detriment to the induction motor in many cases. For instance, if it is desired to use a pinion on the motor shaft instead of pulley and belt, the pounding of the gearing soon wears down the bearings so that the rotor and stator come in contact with each other, which 9 times out of 10 causes a serious burn out. For the same reason, link chains should not be used, nor heavy belts that are put together with iron hooks.

The starting torque of the induction motor as compared to that of the direct-current machine is another point that should have careful consideration in choosing between the 2. The induction motor exerts its maximum torque when at rest, and the full line voltage may be thrown across its terminals, if necessary, for short periods without injury to it. But this causes very heavy currents—from 200 to 500 per cent of full load—to flow, which is very troublesome, especially if the motor happens to be anywhere near the capacity of the generator supplying it with current. For instance with a 200-hp. generator which already has a motor load of 150 hp. and the power factor is 0.80, if it is desired to start another 50-hp. motor which requires a heavy starting current, one that necessitates throwing the full voltage across its terminals, the result is that the generator is called upon to supply current beyond its capacity; that in turn causes all other motors connected to the machine to take on increased current, and all lights, if any are connected to the generator, to burn at about half candlepower until the motor comes to speed. Also, if the lines are fused or have circuit breakers set to protect them, the fuses and circuit breakers would blow out under such circumstances—else they would necessarily be of a size or be set so that no protection would be afforded under full load conditions.

For this reason the writer would not recommend induction motors for use for any purpose where the starting torque required will need more than one-half of the line voltage applied to its terminals.

If none of these peculiarities are detrimental the induction motor has the advantage of being without brushes or commutator, and its extreme simplicity, being literally a shaft turning in the air without electrical connections of any sort, which renders it preferable to the direct-current machine on account of the lower first cost and lower maintenance cost.

Direct-Current Advantages

One thing which must not be lost sight of, however, in figuring the first cost of the induction motor is the expensive starting arrangement or starting compensator as it is called. This cost, added to the motor cost, is liable to be sufficient to give the direct-current motor the advantage in first cost. The direct-current motor may also be preferable on account of the ease with which its speed may be varied, which is practically impossible with the inductive motor.

Extreme simplicity in the alternating-current generator is about all that can be said in its favor, in any case where the work can be done as well with the direct-current machine. The brush and commutator maintenance cost of the latter are a small factor in a well-designed machine, and unlike the direct-current the alternating-current generator when driving a load that is at all variable, requires an attendant constantly to keep its voltage at the normal point, as it is not usually compounded for that purpose like the former.

It is true that various devices, called alternating-current voltage regulators, are on the market, but they are liable to require more attention than their usefulness warrants. The trouble is that more excitation, or more current, is required around the fields for a given load when the power factor is low than when it is unity as the lagging current has more demagnetizing effect upon the fields. Thus for the same current output, 2 different field currents may be required, and a switchboard attendant is about the only satisfactory manner of adjusting those field currents to suit the variable conditions.

The main argument of alternating current advocates is that when the power generated is to be transmitted long distances direct current cannot compete on account of the fact that the latter would require more copper, due to the comparatively low voltage that would necessarily have to be employed.

This is the only real good argument in favor of alternating-current installations. But, if the distance the power is to be transmitted is very great, the cost of line, together with the cost of auxiliary apparatus required, such as transformers and converters, when it is necessary to change to direct current, can easily offset whatever advantage is gained by placing the plant so far away from where its power is to be used.

Summing up and considering all conditions, it might be said that for small central station work, where all the load is for lighting purposes and the individual customer uses only a small percentage of the total output, alternating current will be more economical on account of the higher voltage that it would be possible to use, making the first cost lower.

Large central stations of course install alternating-current apparatus for the same reason, but this is not always the most economical for the consumer. When the distance is very great, say 5 miles from the central station to where the power is to be used and the individual customer uses, say 250 kw. direct current, the consumer can install his own plant and generate his own power cheaper than the central station can furnish it; no matter what voltage they use for transmitting. This is, of course, providing that the central station is a steam plant and has to buy fuel, and the consumer can get the fuel at or near the price the central station pays. But even the cost of fuel ceases to be a factor if the distance is too great.

With isolated manufacturing plants where alternating-current motors can be used to advantage, alternating current would have a slight advantage in first cost, and would have that advantage only when the wiring was not spread over too much ground.

The best advice that can be offered to any prospective purchaser who can use either direct or alternating-current apparatus, is to select that system whose total first cost is the less.

THE SEWALL'S FALLS ELECTRIC PLANT

MULTIRUNNER TURBINES AND CONCRETE DRAFT TUBES

THIS plant of the Concord Electric Co. is located on the Merrimac River 45 mi. above the city of Concord, N. H. The Merrimac River at this point drains an area of about 2,350 sq. mi. and has a normal flow of about 2,500 ft. a second, with an average fall of about 16 ft. The total development, including the installation described in this article, aggregates 2,000 kw.

In the winter of 1904-05, the company decided to add 1,000 kw. to the capacity of the original plant, then consisting of 5 200-kw. generators belted to twin turbines in plate steel casings, in order to supply power to the street railway system projected by the Boston & Maine Railway in the neighborhood of Concord, and to various other consumers of electric power.

The design had to provide for flood variation of some 19 ft. Due to the excessive tailrace excavation required, it was impracticable to locate the addition at the northern end of the old power plant. Placing the installation at the southern end made it necessary that the building be as compact as possible, on account of forebay extensions and in order to reduce foundations and to simplify the protection from the thrust of the river.

Power House Structure

Rubble concrete, reinforced, is used for the substructure and the superstructure is of brick, with a slate roof supported by steel trusses; and hand power crane is provided with the crane girder carried on steel columns.

On the upper or operating floor are located the generators, governors, switchboard, motor generator and blowers for the transformers. In the construction of the floor, provision is made for easy access to the space around the generators, to the bulkheads in the lower floor and to transformers. Removable slate slabs resting on leveling strips are used for this purpose and this part of the floor is made level with the remainder, which is of concrete with smooth mortar finish.

On the lower, or thrust bearing floor, are located the thrust bearings, transformers and a 5-in. motor-driven centrifugal pump for unwatering the turbine pits. The generators are supported on circular concrete bases carried on floor arches, and a platform with steps is provided for reaching the generator collector rings and brushes. The draft tubes are reinforced concrete and the maximum velocity at their outlets is brought down nearly to that of the tailrace. In addition to head gates and tailrace gates, stop log slots are provided.

The dam is a cribwork structure 497 ft. long with planked aprons protected by iron plates. The abutments, wing walls and canal head gate works are of rubble masonry, the elevation of these works being from 13 to 16 ft. above the crest of the dam.

Canal

The original canal, about 1,200 ft. in length, was 11 ft. deep and 59 ft. wide at the top, with a cross-section area of 450 sq. ft. At the time of the installation of the 2 units, the canal was widened to give double the cross-section, and the inner curve was made with considerably greater radius than that of the original canal, because it was found that the angle of the old canal was sharp enough to cause considerable erosion at the curve.

The sheeting of the newly excavated side of the canal toward the river consists of tongue and groove hard pine planks, 3 in. thick, placed in a trench and driven to hard pan. The sheeting on the old bank

of the canal was repaired as necessary and at the upper corner of the station on the canal a concrete wall was built, making this point secure.

It was estimated that the loss in head in the canal end entrance, and down to the mouth of the tailrace, would not exceed 0.6 ft. under normal conditions.

The canal head gates are built of selected Georgia hard pine with slides, guides, trucks and hoisting apparatus, and are arranged so that they may be hoisted by hand or by geared motors.

For a length of 50 ft. the top of the forebay wall serves as an overflow. In this wall is a 4 by 6 draw-off gate for drawing down the water in the canal. For ordinary passage of ice, driftwood and handling waste water a 9 ft. 10 in. by 8 ft. 4 in. overflow gate is provided. The bottom of the opening is 1 ft. below the normal surface of the water in the canal and extends up to the opening and is operated in conjunction with the canal head gates to control the height of water in the canal.

The racks are built up on a structural steel frame resting on a reinforced concrete flooring and are braced back against the building substructure piers. The gratings are of 4-in. by 5-16-in. bars, spaced 1.5 in. in the clear, and are made up in sections with the spacing rods placed back of the center of the bars to allow the teeth of the rakes to pass without catching. The whole is made of sufficient strength to act as a dam, should anchor ice close up the openings and the water be drawn from behind.

The head gates are double, each 15 ft. 6 in. by 7 ft. 6 in., built in 2 parts on account of their large size. Two-part gates were required, since solid gates would have necessitated placing the hoisting apparatus much higher and shutting off the light from the station windows.

Turbines

There are 2 900-hp. vertical triplex open flume Allis-Chalmers turbines designed for operation under normal head of 16 ft. at 100 r.p.m.

These turbines, as shown in Fig. 1, consist of a twin center discharge turbine mounted above a single turbine by means of substantial column construction.

The turbine gates are of the swivel type operated through regulating shafts and connections, the advantages of swivel gates over cylinder gates for this type of turbine being, first, that swivel gates give good efficiency at partial gate opening and equally good efficiency at full gate opening; second, with the use of the swivel type, the increase or decrease in power, resulting from opening or closing the gates, occurs uniformly throughout the stroke from wide open to closing position, which characteristic is necessary for uniformly sensitive regulation from no load to full load.

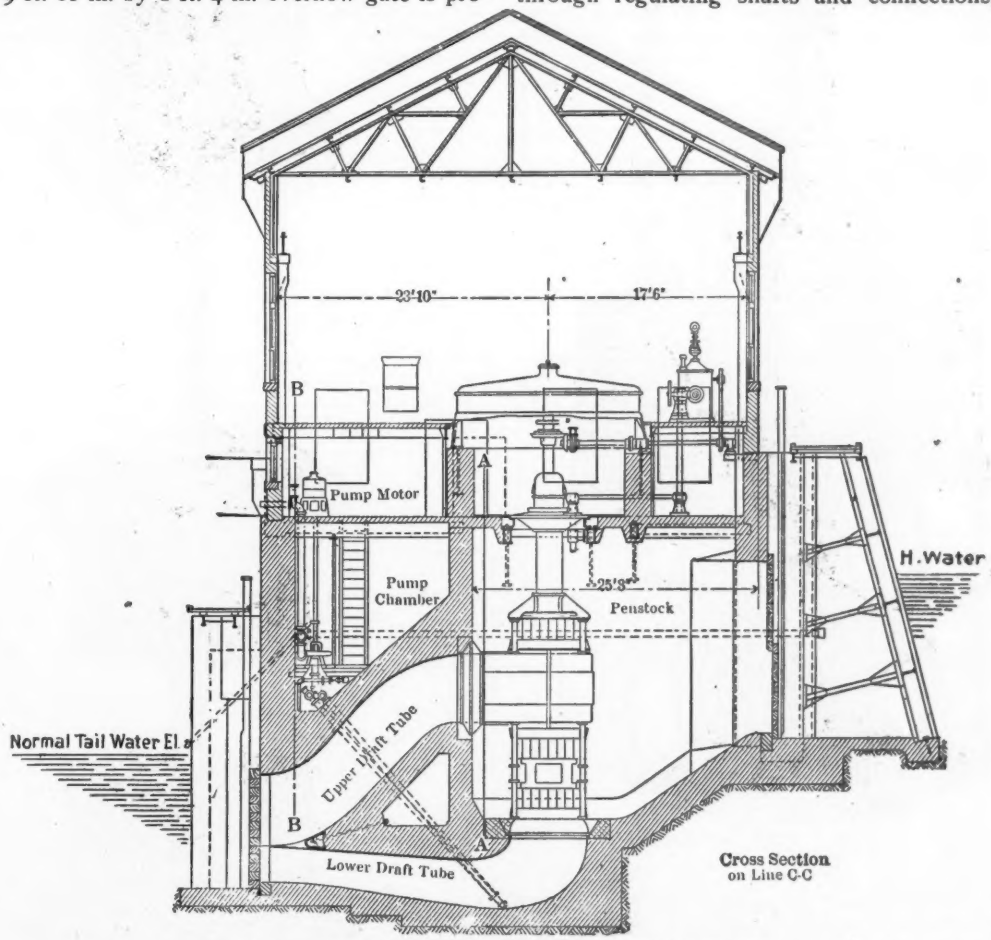


FIG. 1. CROSS SECTION OF THE SEWALL'S FALLS PLANT

Runners

The runners are of bronze, designed to develop 900 hp. at 16-ft. head and 615 hp. at 12-ft. head, with a constant speed of 100 r.p.m. The standard guaranteed efficiency at 16-ft. head and 100 r.p.m., or at 5

per cent above or below this speed, is as given in Fig. 4, which shows the curve for efficiency guarantees. With this curve is given an efficiency curve for this type of runner obtained from a recent test at the Holyoke Testing Flume; it will be seen that the efficiency actually obtained on the test is considerably higher than that guaranteed.

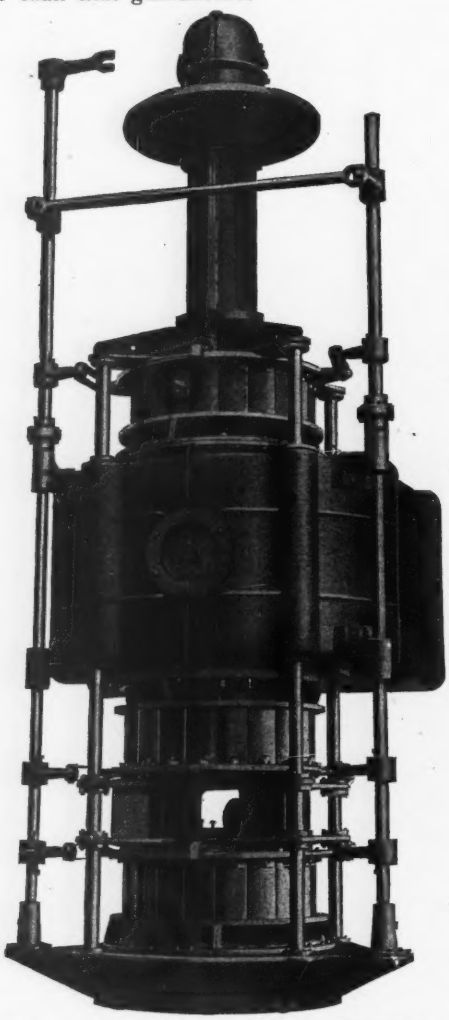


FIG. 2. ALLIS-CHALMERS TRIPLEX TURBINE

Governors

The governors used to regulate the speed of the turbines are of the Allis-Chalmers oil-pressure type, and in this installation they are arranged so as to be entirely self-contained, the rotary oil pump, tanks, regulating cylinder and governor mechanism proper being mounted on a single base. The governor head and pump are driven from the main shaft by means of bevel gears and the regulating piston is connected to the regulating shafts by means of a simple link arrangement, avoiding, as is the company's regular practice, the use of gearing and the lost motion inherent in such arrangements.

Draft Tubes

The concrete draft tubes, as shown in Fig. 1, built from plans furnished by Allis-Chalmers Co., were designed to lead the water to the tailrace from the center discharge casing and lower runner with uniformly decreasing velocity and minimum hydraulic disturbance. The object in this, as with all draft tubes, was so to construct them as to abstract the greatest possible amount of energy from the water before discharging it into the tailrace. A striking example of the losses sometimes incurred with short, straight draft tubes is shown in a recent case where 27 per cent actual increase in plant capacity was obtained

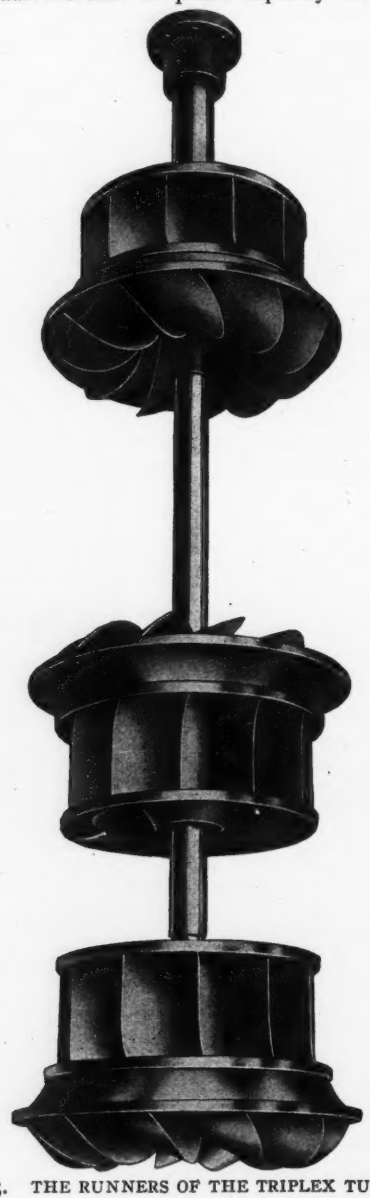


FIG. 3. THE RUNNERS OF THE TRIPLEX TURBINE

by replacing a straight short wrought-iron draft tube with one properly designed and constructed of concrete.

The thrust bearings are oil-bath and self-contained, a construction which results in a large saving of oil. In a plant containing 8 875-hp. vertical turbines, an actual saving of over $6,000 a year in oil was effected by replacing pressure thrust bearings, by oil-bath bearings.

Generators

There are 2 500-kw., 3-phase, 60-cycle, 2,600-volt Allis-Chalmers vertical direct connected revolving field generators.

The stator is bolted to the cast-iron supporting ring, which is carried upon concrete foundation beams worked into the lower floor, and has bolted to its top the spider which supports the guide bearing.

The rotor is of the umbrella type supported from the center and extending down over the outside of the stator; it is constructed of cast steel and especially designed to withstand the stress due to its great diameter and position with reference to its field coils. It is mounted on a short shaft, the collector rings being arranged immediately above the coupling to which the turbine shaft is connected.

Excitation is furnished by 1 45-kw., 125-volt, compound wound generator, direct connected on the same cast-iron base plate to a 75-hp., 60-cycle, 3-phase induction motor wound for 2,600 volts at 680 r.p.m. This type of exciter was chosen in preference to a water-wheel driven unit on account of the necessity of economizing space as much as possible.

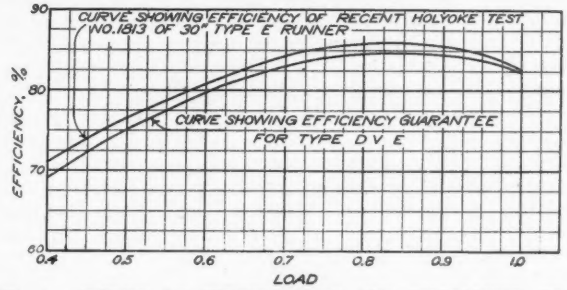


FIG. 4. CURVES OF PERFORMANGE AND GUARANTEE OF RUNNER USED IN TRIPLEX TURBINE

Switchboard

The switchboard is of blue Vermont marble, 21 ft. 4 in. long, divided into panels. The generator, exciter and exciter motor have each a separate panel with a blank panel for a future line.

The 10,000-volt air blast, step-up transformers are placed on the floor, and are provided with ducts below and connections to air shafts communicating with the blowers. A damper is provided for shutting off air from each set of transformers.

Costs

The approximate cost per horsepower of the vertical triplex open flume turbines direct connected to vertical generators, complete with governors, is about $18 per horsepower; and, compared with this, that of an arrangement composed of 2 single vertical turbines set in a common open flume, geared to horizontal generators complete with governors, is about $13 per horsepower.

The cost of the power house for the vertical triplex, direct connected arrangement may be fairly estimated at $21,600, including $9,000 for building and $11,600 for excavation, structural steel, etc. For the single geared arrangement, the cost of building would, of course, be higher, due to nearly double the floor space required, and would be at least $11,000 for building and $12,400 for excavation, structural steel, etc.

The triplex direct connected units will have a combined guaranteed efficiency at normal load and normal rating of 76.2 per cent. The single vertical geared turbines will have a combined efficiency of not over 51.5 per cent., taking into consideration the efficiency of the runner, generator, draft tube, gearing and bearings.

If we assume in each case a cost of real estate waterways, etc., of, say, $75 per horsepower, we would have an initial investment for the vertical triplex arrangement of about $189,000, and for the single geared arrangement of $181,000, or a saving in first cost of about $8,000 in favor of the geared proposition.

If, however, we figure conservatively the interest on the investment, insurance, taxes, depreciation in the buildings and machinery, general maintenance and operating expense for both arrangements, and assume a figure of, say, 0.75 cents per horsepower-hour for the price obtainable for power, we find as a result of the greatly increased efficiency obtainable with the vertical direct connected triplex units over the single turbines geared to a jack shaft that we can obtain an increase in returns on the investment in 1 yr. with the vertical direct connected units over the old-fashioned geared arrangement which would alone pay the interest at 5 per cent on a $400,000 issue of bonds.

This illustrates the fact that the general principle which is universally recognized in connection with all other types of power machinery, such as steam engines, pumping engines, steam turbines, etc.—i. e., that the additional initial outlay required to obtain the best and most modern construction is more than offset in the increased efficiency and consequent increased returns on the investment, is also applicable in the hydraulic turbine field.

DESIGNING ELECTRIC TRANSMISSION LINES

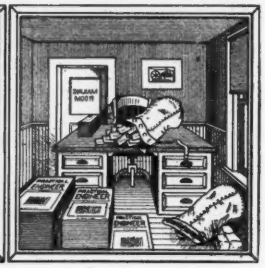
In the Clarkson Bulletin, F. S. Stone gives as the result of experience in designing 2 transmission lines for a Colorado plant, where one of the lines was carried 3 miles and the other 1.25 miles, the following rules:

The area of the conductor in circular mils equals the distance of transmission one way in feet multiplied by the total watts delivered at the receiving end, and by a constant which depends upon the power factor, and divided by the per cent loss in line, and by the voltage between the main conductors at the receiving end. The value of the constant for any particular power factor, is obtained by dividing 2,160 by the square of the power factor for single-phase circuits, and by twice the square of the power factor for 3-phase circuits. The resistance of line wire is taken at 10.8 ohms per mil-foot and in the case considered where the power factor was 85 per cent and a 3-phase system used, the constant was 1,500. This method will not apply to long lines, but was accurate enough for all purposes in the case mentioned.

TRACKLESS TROLLEY CARS are now in actual operation in various capitals of Europe; the Mercedes-Tiolla system is operating in various parts of Austria, especially in Vienna; the Filobia is used in the northern part of Italy, especially in Milan, and the Schieman is employed in the Rhine valley The vehicles used look like single deck omnibuses, and have arrangements for taking current and returning it to the 2 overhead trolley lines. The Vienna system has 2 sets of cables, 1 for going and the other for returning cars, while many others use only 1 set of cables and the vehicles which meet stop to change over connections. The connection from trolley wires to motors is by means of flexible cable, the trolley wheels being supported and carried by the 2 wires and kept in contact by a weighted pendulum. In the Filobia system, 2 pairs of wheels are used and are pressed against the under side of the cable by a trolley pole, while in the Schieman system, the contact is by means of a pair of sliding shoes on the end of a pole. These systems give a lighter car than is necessary where the carriage has the prime mover within itself and avoid the expensive track construction of the trolley car system.

Letters From Engineers

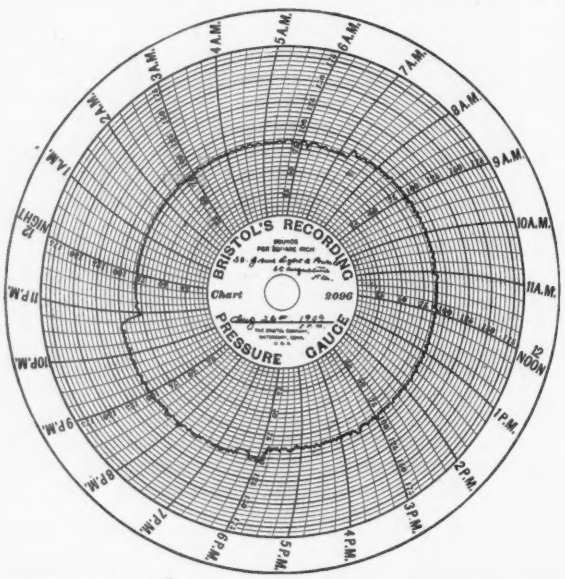
Tell us about your new kinks and new thinks. Rough sketches are always helpful; we make the drawings. Cash paid for accepted contributions.



Automatic Appliances

How often we meet power plant owners, as well as a few engineers, who object to automatic devices, their argument being that it makes their employes careless, and that they will depend entirely upon them. To those who think this way, the writer will say that they do not appreciate the real value of these appliances, of the extra safety and economy that they impart. Of course they all need attention, and the engineer or fireman should know that they are doing their work. But it is interesting as well as profitable work.

Try to put yourself in the inventors place and study out just what he had in mind and make yourself familiar with every little detail of all automatic devices. Do not be too ready to condemn any appliance. If you



RECORDED PRESSURE OF BOILER FIRED WITH HARD PINE

are beaten, get in touch with the makers, they are always ready to aid an engineer. Do not allow your damper regulator to run on a variation of 10 lb. when the makers claim one or less. There is a reason if it does not do what is claimed for it. Look to the pilot valve, clean and oil it and see that its travel is divided equal. See that the bar swings free, for it takes but little friction at this point to effect the variation. This is one of the most valuable automatic devices we have.

Then there is the high and low water alarm. Should they fail to whistle either way, know the reason the next time the boiler is down. A pin connecting the lever may have dropped out, or a float may leak. Remember that no man is infallible, therefore that which he produces cannot be absolutely perfect.

As we use hard pine wood for fuel, engineers will appreciate the good work done for 24 hr. by 3 firemen, which is shown by the accompanying illustration, which is a reproduction of a card taken here recently. This is not an unusual card, for as good work can be seen here almost any day.

To show that I believe in automatic devices, I have installed apparatus in my present plant as follows: G. M. Davis stop and check valve on each boiler lead. Reliance high and low water alarm columns. S-C water-level regulators, (Icall them my little watchmen, no more running to the boiler room every few minutes to see why the whistles blow). S-C pump governor. Lawrence damper regulator. Hart automatic oilers on all engines and pumps. G. M. Davis automatic condensing and free exhaust valves. A Foster and a Mason reducing valve. Besides these we have electrical and steam charts. Alternating current high voltage bell alarm, street railroad blow-out bell alarm and bell alarm for low steam. I would not do without any one of these. This does not mean that other makes are not just as good as these, but that I value each appliance that I mention and that it is a pleasure to keep each one in order as well as a profit to my employers.

J. F. Miller.

Correction Notice

In the article entitled Radius of Bumped Head by Charles J. Mason, on page 552 of the September issue, we wish to call attention to a few typographical errors.

The 7th line from the bottom of the first column should read: The point F is measured off, etc. In the 4th line from the top of the 2nd column the number 26.65 should be 26.25. The expression

$$\frac{21^2 + 10.5}{10.5} = 52.5 \text{ should be } \frac{21^2 + 10.5^2}{10.5} = 52.5.$$

The radius thus obtained should be 26.25 instead of 26.2 as printed.

Valve Adjustment

In the August number of Practical Engineer, page 495, Mr. Freeman gives some compound engine cards on which he asks advice. There is practically only one thing necessary to do in this case, and it must be done on both high and low pressure cylinders, and that is, to advance the eccentric in the way the engine is to run, which will make admission, release and compression earlier, all of which at present show late.

Mr. Freeman says that his opinion is that to put the eccentric back would better conditions. Now, this would only make the adjustment worse, because it will make everything still later. The low pressure cut-off needs equalizing by adjusting the governor rods, after which he will have conditions beyond criticism.

A. C. W.

Referring to Mr. Freeman's article on page 495 of the August issue, I would think that he should know

that in order to bring about events earlier in the stroke the eccentric must be shifted in the direction of the rotation of the crank shaft, that is, forward, not backward. But the eccentric should not be moved at all, for diagrams from a single eccentric engine the ones he shows could not be improved upon, if a quiet, cool-running, economical engine is what is wanted.

It would be a little better if the exhaust valves could open a little earlier in the stroke, but this is impossible without turning the eccentric forward. To do this would increase both lead and compression, and compression means loss of power and lead means a noisy engine.

Apparently Mr. Freeman is not satisfied with his diagrams; if so he is one man who is doing better than he knows and against his will.

The diagrams are the best that I have seen published illustrating correct practice for years. If more engineers set valves and run engines as he does there would be less talk about pounding engines and hot boxes and engineers would show that they understood their business, and they would get better pay.

V. E R.

The cards presented in August number by Edw. A. Freeman surely could be improved by moving eccentric back as he suggests. It may be necessary, also, to make some adjustments of the valve rods; but probably if the eccentric is properly set that will be sufficient to produce a good card. W. E. D.

It is easily evident from Edw. A. Freeman's engine cards that he should make the admission earlier, and the compression a little greater; also the cut-off on the H end should be a trifle earlier. J. H. J.

Wedge Bolts for Crosshead Brasses

I note the letter from O. L. H., page 496, in the August issue of the paper. Some years ago I had similar trouble with the bolts in the crosshead end of the connecting rod breaking as described by O. L. H. Finally I found what I thought to be the cause of the continually breaking bolts and applied the remedy of which I am about to relate. As the breaking ceased, never again to occur during a period of several years, sufficiently long thoroughly to test the matter, it would seem that we had struck the right thing, both with regard to the cause of the bolts breaking and also the remedy applied.

If all the details of the end of the rod were absolutely correct, that is, if all the bearing surfaces were flat, true in every direction, and the bolts, holes in the rod end as well as the topped holes in the wedge block were also true, then there would be no breaking occur, for there would be nothing that could break them. The bolts should endure nothing but a moderate tensile stress, considerably less than that required to even strain them, let alone that which would actually pull them asunder, but sometimes they are subjected to a shearing stress as well, and so in time they will break.

Now the way we remedied the trouble was this: The rod end was stripped and an examination made of each individual part. We found that when the wedge block was secured by the adjusting bolts, it did not remain flat against its seat at the butt of the rod; that is, tightening the bolts pulled the wedge off its seat at 1 end. This was due to the several faces not being parallel and square to each other respectively, as discovered by testing them for parallelism and for being square.

We reamed out the holes in the rod end so that the adjusting bolts would not lift the wedge block from its seat against the butt of the rod, and had a new pair of bolts made with a narrow bearing surface under the head, so as to reduce the leverage that originally caused the bolt head to break off. We also left a small fillet under the head further to strengthen that part, as a sharp corner in that place only tends to invite a break if the other conditions are ripe for such, as in our case.

When the bolts were made and ready to place, they had the shape shown in Fig. 1.

With such a head, if there still remained any inequalities, it would act somewhat as a universal joint and yield sufficiently to meet such without at all unduly straining the bolt. We never had any further trouble on that score.

If O. L. H. examines and tests his rod end, wedge block, and adjusting bolts and holes into which they go, as suggested in the foregoing, and applies the same

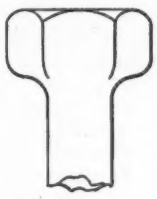


FIG. 1

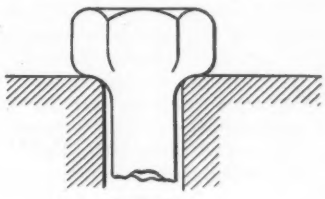


FIG. 2

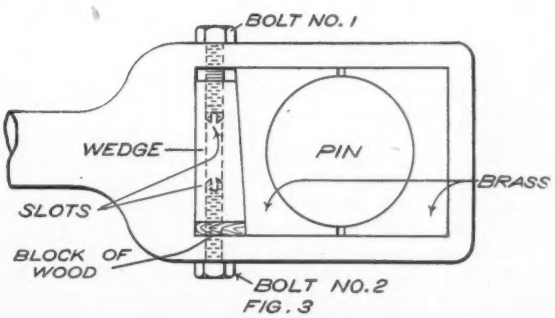


FIG. 3

FIG. 1. CROSS-HEAD PIN BOLT

FIG. 2. CROSS-HEAD PIN BOLT IN POSITION

FIG. 3. CONVENIENT METHOD FOR REMOVING WEDGE BOLTS

remedy, or a modification of it to suit his own peculiar case, I think he will permanently stop the breaking of bolts of which he complains. C. J. M.

I would suggest to O. L. H. that it is difficult to locate the trouble without knowing all the conditions. There must be an excessive strain on them caused by a wedge that is too steep or some side strain. I would run over the engine and test the alignment the first time it is shut down. In the meantime fit a shim under the wedge and put a hole through it for bolt No. 2, so as to take up some of the strain on bolt No. 1. If you cannot locate the trouble make some thin shims for adjustment.

I would also see to getting some bolts made, personally, have them made and tempered blue and get steel that you know is good. Machine-shop men are not much interested in your engine as I find them.

A. M.

One of our engines gave us much trouble on this score. We finally concluded that the bolts furnished by the engine people were too hard, so we secured some mild steel stock and made some bolts. In the 2 yr. since then we have not lost a bolt on that engine. I would advise O. L. H. to try this.

Also, I would advise him to fit a block of hard wood under the wedge to prevent its dropping in case the upper bolt breaks. This will often save a shut down.

Another kink that will save time in case a bolt breaks is to slot all bolts for screwdriver before putting them in. Use two blades in a hacksaw and make a good slot in end of bolt. Then if upper bolt breaks, take out lower one with wrench, and by inserting screwdriver the remains of the one may easily be backed out. W. E. D.

In reply to O. L. H.'s inquiry in the August number of Practical Engineer it would seem that there was a binding stress on the bolts, and while it might not be very severe it is repeated so often that it breaks the bolt in time. We have had the same trouble here on 2 larger engines, 950 and 1,500 hp., cross compound, direct connected, and running at 111 r. p. m., carrying a street railway load.

When the station was first run there was considerable trouble with the crosshead pin wedge bolts breaking in just the manner that O. L. H. mentions. We took a round file and filed the hole through the strap a little larger so as to give the bolt a little more room and we found it an improvement. Then we made some new bolts and turned the body of the bolt above the thread 1/16-in. smaller and turned a little off the under side of the bolt head so that it did not have so much of a bearing and leverage on the head. Since then it is a rare thing for a bolt to break. C. B. S.

Engine Troubles

I am pleased to see in the last issue a method of renewing dry batteries. I will try it.

I wish to relate some of my engine troubles and how I overcame them and ask for further suggestions for improvement. I have a 14-hp., 30-in. Corliss engine made here in Mexico. It is necessary from the

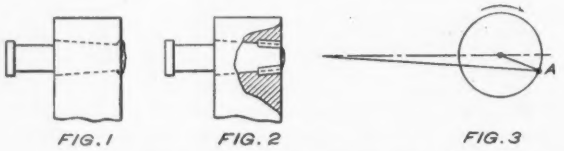


FIG. 1 FIG. 2 FIG. 3

FIG. 1. CRANK PIN AS ORIGINALLY RIVETED
FIG. 2. METHOD EMPLOYED TO TIGHTEN CRANK PIN
FIG. 3. POSITION OF CONNECTING ROD WHEN POUNDING OCCURS

size of the business and other conditions to use cheap labor in the engine room, keeping the machinery in repair myself.

About a month and a half ago the engineer was starting up and thinking the engine was starting too fast closed the throttle valve completely. The heavy condensation in the cylinders caused a suction on the exhaust, I imagine, and pulled in water from there which was closed in when the valve closed for compression. There was a drain in the exhaust line, but it did not carry the water off immediately when starting.

At any rate as soon as he closed the throttle the crank was snapped off. If you have any other explanation I would like to hear it.

I took out the connecting rod and crank shaft, with the aid of 2 men and a jackscrew, hauled it one mile to the station in a 2-wheeled cart and expressed it 300 miles, had a new crank cast and finished and my connecting rod straightened. On the fifth night it was back in the engine and the lights were on at the usual time. One of the above days was a holiday and I could get no work done. I think that's not bad for Mexico if we are a people of to-morrow.

In making and fitting the new crank pin the shop man evidently did a poor job, for it came loose the first week. It is a taper pin with a riveted head, Fig. 1, and was supposed to be put in with 15 tons pressure, hot. The head either had been overheated or hammered too much because it was crystallized.

I drilled 3 holes just so as to take half the pin and half casting. Then forced the pin in as far as possible and tapped the holes, using a 19/32-in. tap. I then screwed in a plug which fit tight in each one. But as the hole had evidently worn some before I discovered it the pin came loose again, and I repeated the process on the other side, and managed to get in a thin shim at the same time. The last time I put the jack so as to press the pin in and a large hammer on the outside and spent about 2 hr. riveting with the idea of expanding the point of the pin. It hasn't come loose again, but I don't feel very sure of it. It has been running nearly a month now in good shape.

The engine has not a good foundation, as it is set in a swampy place. I have tested it for line and it seems to be all right, but for level it is about 1/32-in. low on the pillow block. Now at times, when the valve lifts get a little worn and it occasionally takes too much steam on the head end, there develops a knock in the pillow block much as if one were striking with a sledge. As a forerunner to that there develops a click in the drive wheel, as near as I can locate it. The wheel is perfectly tight and sound. Probably the cause is the same as the one that causes the sound in the pillow block. Also when it is pounding I can see a torsion in the frame of the engine.

I can keep it running smooth by watching the lifts carefully or when the pound develops by giving her most of the steam on the crank end, but there is something wrong and I'd like to have some advice how to remedy it. A. J. W.

Test Vacuum Gage

In relation to F. W.'s pump lifting 28 ft., as shown by gage, although this is possible, it is well to remember that a vacuum gage is not a very reliable instrument. A mercury column is much more reliable and if properly connected F. W. can find out just what his lift is. W. E. D.

F. W.'s letter in the August issue is a hard question to answer. I would suggest that he get an aneroid barometer and take a reading and compare it with his lift.

Take barometer reading, multiply it by 0.49, divide the product by 0.43; 0.49 gives the pressure of atmosphere; dividing by 0.43 gives the column of water pressure which will balance. I would then suggest that he examine his vacuum gage. J. R.

In reply to F. W. would say that the amount of friction of water in the suction pipe would show on the vacuum gage at pump. And again the vacuum gage may not be correct. We have 2 on a surface condenser and they both read 5/8 in. more than a mercury gage setting by the side of them.

On our jet condenser the vacuum gage would indicate it was lifting water 29 ft., when I know it is only 12 ft. The rest of it is due to the injection valve being nearly closed. C. B. S.

How to Fix Piston Rod; Method of Welding Boiler Tubes; Acid for Brazing

There is a right and wrong way of fastening the piston rod to the cross head. Figure 1 shows a fre-

quently used but wrong way, because by working, the length between A and B becomes longer any way or any time that you want to tighten the piston rod.

Figure 2 shows the proper method; when the engine is at rest the distance between A and B can only be shortened by the pressure of the key against the shoulder A, which is nothing at all, and, when working, the strain is equally divided all over.

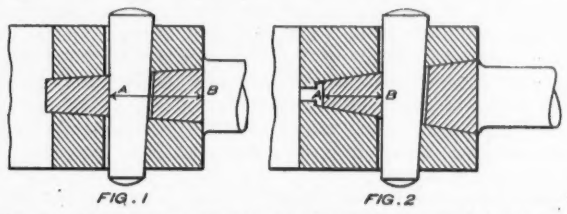


FIG. 1. IMPROPER METHOD OF FASTENING PISTON ROD TO CROSS HEAD

FIG. 2. PISTON ROD PROPERLY KEYED TO CROSS HEAD

It often happens that a boiler tube is spoiled at 1 end and to save it a new piece must be welded on; for this purpose use the following method:

Take an old piece of shaft about 2 ft. long; at 1 end weld a ring and a piece of pipe long and big enough to hold in the fire. Turn the shaft down so as to fit the inside of the tube. Cut off your old tube and a new piece of tube, put both on the shaft, place in the fire and weld. Figure 3 shows clearly how this work can be done.

If you want to have a good and sure brazing of 2 pieces of iron whenever you use copper or brass for

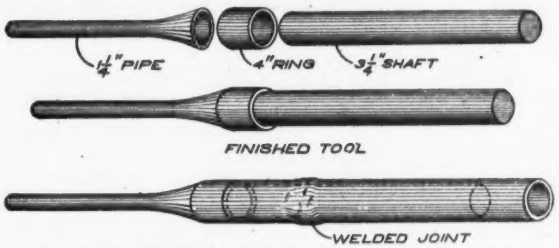


FIG. 3. TOOL AND METHOD USED TO WELD TUBES

your brazing, dip the 2 ends for about 1 minute into a solution 0.5 water and 0.5 nitric acid; then wipe off with clean waste and proceed to your brazing. Keep the solution in corked bottle. C. L.

Air Heads to Stop Water Hammering

Concerning the trouble of I. H. J., as published in the August issue of Practical Engineer I would suggest that he replace his check valve at the pump and put air heads on his main. By cutting the main he may put tees in and put heads on these. The heads may be 12 or 14 in. high. I am sure this will stop the hammering, which I know is nerve racking as well as injurious to plant. J. R.

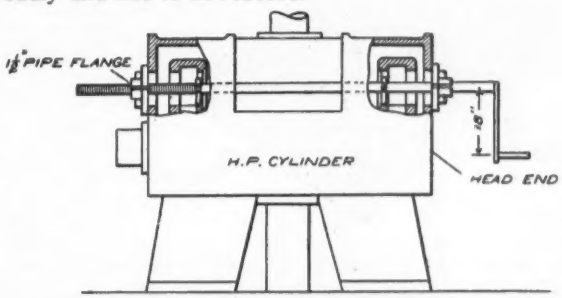
Steam Consumption from Indicator Diagram

Regarding the article on "Steam Consumption from the Indicator Diagram" in the August issue of Practical Engineer, I wish to say that I have been of the same opinion as most engineers, i. e., that it is mostly guesswork to get the consumption of steam in an engine by this method. I have, however, had the opportunity to make several tests to find the amount of steam used per horsepower-hour by an engine, and have used the method in connection with the one in which all the water fed to the boilers is weighed. Utmost care was exercised in performing the tests, and after careful calculations it was found that a high-speed engine used 44 lb. of water per horsepower-hour, by actual weight, and 42.9 as figured from the card, an average of 8 cards being taken, and a Corliss engine used 27.4, by actual weight, and 26.7 lb. as figured from the cards.

The above figures show that with due care exercised in working out a card the amount of water consumed per horsepower-hour can be obtained close enough for most practical purposes. J. H. J.

Stopping a Leak in a Piston Valve

The accompanying sketch is of a job I recently completed on an old tandem-compound Fitchburg engine, made in 1888. This engine has expansible piston valves which on the high-pressure cylinder leaked badly and had to be rebored.



METHOD OF BORING VALVE SEATS

I made a boring bar out of a piece of 2 7/16-in. cold rolled shafting. A pair of 1.5-in. pipe flanges were secured; one of these I threaded 18 threads to the inch and threaded the bar to fit; this was used for the feed. The other flange I bored to fit snug on the other end of the bar. Each flange was sawed through on 1 side and a rough clamp was made to go around the outside with a bolt to take up the wear and prevent chattering. Each flange had 2 pieces of 1 in. sq. machine steel planed and bolted to it by cap screws. These were long enough to project by the studs that hold the bonnets on and by making straps with holes to fit over the studs I clamped a pipe flange to each end of the cylinder. The tools to bore with were made out of round steel, inserted in holes drilled through the boring bar and held in place with set screws. One of these tools cut going ahead and the other cut backing up. This arrangement was necessary as the holes were only 5.5 in. in diameter and I could not reach the tools except as they came through the holes into the counterbore.

By taking light cuts I got good true holes. The power I used was a crank 18 in. long run by "armstrong" power. With 2 helpers we bored out 4 holes in about 2.5 days, but it took some time to set the boring bar, as it was rather snug quarters.

After the holes were finished, I was worse off than ever as I had no valves but the old ones, so I turned the outside shells down as small as was allowable, made a pattern, got some castings and made bands and forced them on to the valves already turned down. I left 1/32-in. stock to finish afterwards. When I got the bands on, which were about 5/16 in. thick on each side, I pinned them on by screwing 3/16-in. brass pins through the bands into the old shells. The next thing to do was to cut the ports out, which I did with a cutting off tool.

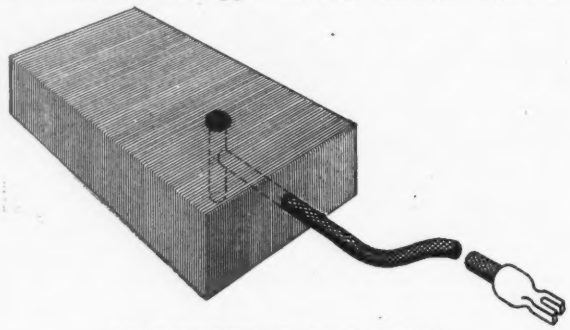
The valves were now ready to be cut lengthwise, which I did with a hacksaw. I then set strips of

copper in on top of the original brass strips, as I had no brass, pinned them in and turned the valves down, as I had 1/32-in. stock, to fit the holes already bored out in the high-pressure cylinder.

This engine has been running about 7 months since the job was completed and is doing fine. The company I am working for bought this engine for a new mill after it had been running day and night in a pulp mill for 19 yr. H. A. B.

Soldering Cable to Carbon Brush

In answer to W. C. R.'s query in August issue of Practical Engineer I will say that he can not get any flux that will unite copper with bare carbon. The con-



CABLE SOLDERED TO CARBON BRUSH

nection is easily made, however, if the brush has a light coating of copper plating on the end. But as this is quite out of the question in a majority of plants I will suggest a way out of his difficulty.

Drill a hole in the end, also in the side of the brush, as shown in the sketch, and after thoroughly tinning the "pig-tail," place it in the end hole, and fill the holes up with solder through the side hole.

With a little care in drilling the carbon, as it breaks easily, the job can be made quite satisfactory. S. B.

In reply to W. C. R. in the August issue I would say I have run up against the same thing several times and soldered the cables as follows: Drill a hole through the carbon so that the cable will just slip through, countersink the edge of the hole a little, clean the cable thoroughly and pass it through the hole. Then with any good flux and solder fill the countersunk part on both sides and your cable will hold and also carry the current required of it. L. J. H.

Diagram Figured Out

In reply to Chas. Sweeney, whose letter appears in the September issue of the Practical Engineer, page 554, I offer the following:

From the data he has given, and after applying the planimeter to the diagrams shown, I find that for diagrams marked A the mean effective pressure figures out 69.6 lb. and the indicated horsepower 304 +, or nearly 305. The steam consumption figures out 22.5 lb. per horsepower per hour. Allowing for possible and probable losses, which the diagrams would not show, say to the extent of 20 per cent, brings the consumption up to 27 lb. per horsepower per hour.

For the diagrams marked B the mean effective pressure is 45 lb. and the indicated horsepower is 201. The steam consumption figures 20.5 lb., and, making a further allowance of 20 per cent, brings it to 24.6, or, in round numbers, 25 lb. Of course, it should be understood that measuring steam consumption from indicator diagrams is but an approximate method at the best and can not be relied upon. For ordinary purposes the figures given above are sufficiently close, and they will serve to show what is being done by the engine to which they relate.

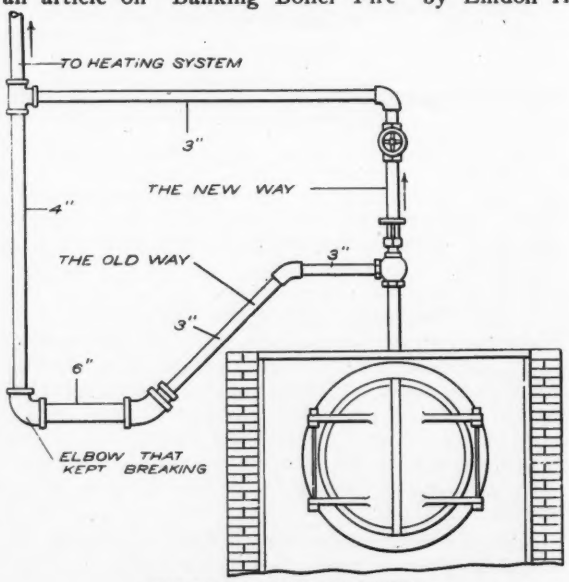
The diagrams show a pretty good steam distribution, due to good valve setting. If one were extremely particular and desired to improve the condition of affairs, referring to diagram B, he might cause the exhaust valves to open just a little later than at present, and also he could reduce the compression by a small amount. These might be considered refinements that perhaps would not pay to bother with, but suggestions have been asked for, and so they are given for whatever they may be worth.

Diagrams A show an overloaded engine when considering steam economy in the abstract. Of course, the engine is doing better as shown in diagrams B, carrying a load better suited to that size engine. But even there, the terminal pressure is a little too high for best economy attainable, which may be remedied by decreasing the load or increasing the boiler pressure, if all the other conditions permit such changes being made. Charles J. Mason.

Piping Problem; Boiler Firing

I enclose a sketch of a problem that I was compelled to solve some time ago. I had a heating boiler that was used to heat 1 building of a factory. The 3-in. steam main came up from the boiler about 12-in., then ran horizontally for 5 ft. 8 in., then down at a 45-deg. angle to a 6-in. main, the drop from the top of the boiler to the 6-in. main was 8 ft. so when the boiler was steamed real hard, the water would lift, form a syphon and fill the 6-in. main full. The water hammer was sufficient to break the 6 by 4-in. ell, but after I changed it to the arrangement shown in sketch, my trouble in that direction was over.

In Practical Engineer for July, page 434, appeared an article on "Banking Boiler Fire" by Lindon A.



PIPING OF HEATING BOILER

Cole, giving his method of performing that work. I fail to see how any fixed rules can be adopted, for in different plants, different conditions will be encountered. If Mr. Cole was in a plant where a full load was carried right up to shutting down time with about all the boiler could do, he would have to fire his prettiest or get a call down and the method he suggests could not be employed. H. A.

QUESTIONS AND ANSWERS

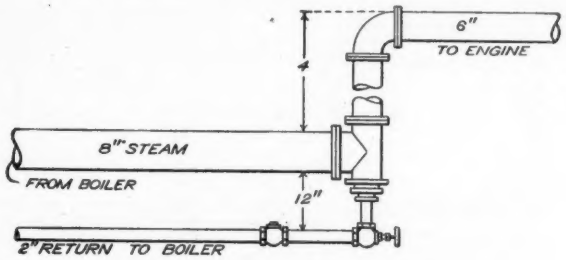
Our readers are invited to send in their troubles and problems; also to answer questions which are asked. All letters must have name and address of writer, which will not, however, be published. If answers are wanted by mail, send stamp for reply.

Quantity of Cylinder Oil Required

What amount of good cylinder oil will it take per day of 24 hr. to lubricate the cylinder of a twin cross compound engine with 2 21-in. high pressure cylinders and 2 42-in. low pressure cylinders, with 36-in. stroke running 80 r. p. m. with 80 lb. steam pressure, and a 4.25 by 5 in. vertical engine direct connected to a generator running 500 r. p. m.?

I would like to know also if there is a rule by which to base the amount of cylinder lubrication of different size engines at different piston speed.

Since taking charge of this station, I have reduced the cylinder oil consumption a little more than 50 per



METHOD OF DRAINING STEAM PIPE

cent per year or from 5 barrels to 2 barrels a year. I have had the cylinder heads off several times and find the cylinders in better condition now than when I first examined them. The cylinder walls are in good condition, average steam pressure 80 lb., average height of water in boilers between 1 and 2 gages, steam pipe from boilers to engines 40 ft.

We have no separator, but use a 2-in. return pipe to carry off condensation, as shown in the illustration. Under these conditions, I think our engines get fairly dry steam. The little engine takes steam off the big engine steam pipe. L. W. V.

Points in Boiler Design

1. How do you calculate the strain or bursting pressure on a Morrison corrugated furnace?

2. Why is it that the inside sheet of a Manning boiler needs stay-bolting, when a Morrison furnace, also under a collapsing strain, does not require stay-bolting?

3. Why is it that a rivet in double shear has not twice the shearing strength of one in single shear?

4. How is a bumped head, as in a B. & W. boiler, stronger than a flat head, and why is it flanged inwards to a depth of 3 in.? R. W.

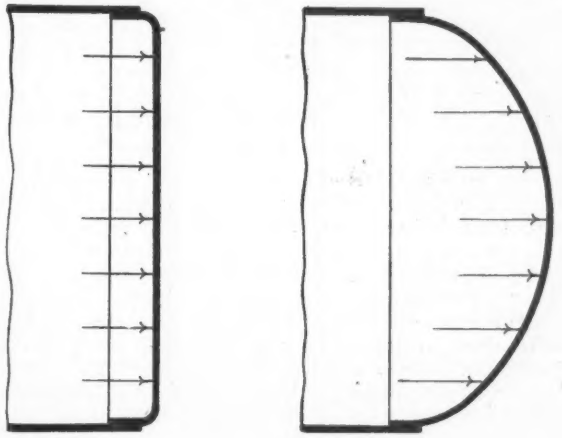
A.—1. The rule given by Lloyd's for strength of Morrison furnaces is: to find the working pressure, from the thickness of the plat expressed in sixteenths of an inch, subtract 2, multiply the difference by 1259 and divide by the greatest diameter expressed in inches. The result will be the same pounds per square inch. The bursting pressure would be about 6 times this.

2. The Morrison furnace is corrugated and the "U" shaped rings give the furnace stiffness so that it does not need support as does a Manning boiler furnace.

3. The rivet in double shear has more chance to be badly driven, so that it does not fill the hole, than does the rivet in single shear. Also there is a tendency for the rivet to bend if the heads are not tight down to the plates.

4. In the case of the boiler head, if it be flat, the pressure is straight against it, tending to bend it outward, as indicated in the illustration herewith. If, on the other hand, the boiler is bumped up to a considerable radius, the pressure is to a certain extent in line with the plate instead of tending to bend it. Any kind of a vessel tends to take a cylindrical form under an internal pressure and the nearer it is made to this cylindrical shape in the first place, the less is the tendency for it to change shape under pressure.

When a hole is cut in any surface, whether it be



DIRECTION OF STRAIN IN FLAT AND BUMPED HEAD BOILERS

flat or rounding, this hole weakens the plate and a flange turned in around the hole tends to stiffen the plate where material has been removed and thus make up for the weakening effect. Flanging in acts to a certain extent the same as riveting a piece of angle iron would do.

How to Remove Bolts from Boiler

I would like to know the best way to remove bolts from a boiler as I have some in a traction engine boiler that leaks. They are the bolts that hold the bearings for the main drive shaft. They leak only when the engine is pulling a hill. I also have to put on a new fly-wheel shaft bracket. Would like to know the best way to fix it. There is no machine shop close, so I have to try to fix it at the ranch. Answers from engineers through the columns of Practical Engineer would be appreciated. H. H. G.

ANSWERS TO MARINE ENGINEERS' EXAMINATION

JULY ISSUE, P. 431.

By Charles J. Mason

1. No, because the influence of other events in steam distribution, on the lead line of a diagram obscures the lead action.

2. 379.48 deg. F. is the temperature for 180 lb. gage pressure steam.

3. The principal causes of boiler deterioration are internal and external corrosion, and also the effects of unequal expansion and contraction; also grooving and uniform wasting away of the plate tube ends, etc. It generally begins at or near the water line inside, and near the point of delivery of feed water. At the bottom and ends on the outside; due to the influence of the bilge water and vapor from it.

4. For a cylindrical boiler 12 ft. in diameter made of steel with a tensile strength of 60,000 lb. 15/16 in.

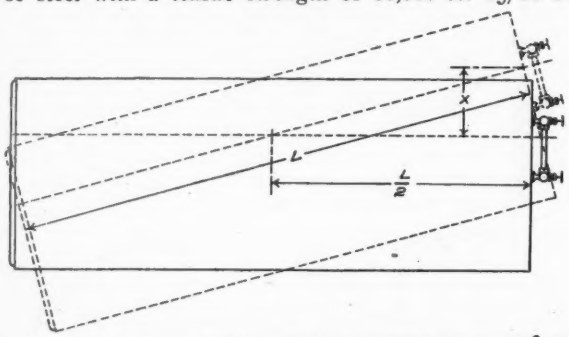


FIG. 1. CHANGE OF WATER LEVEL WITH LIST OF 15° IN SHIP

thick and lap riveted joints of standard proportions with a factor of safety of 6, the pressure allowed by the United States Inspector will be as follows:

1.2 x 60,000 x 0.9375 ÷ 6 x 72 = 156.25 lb. per sq. in. This allows for double riveted seams.

5. For a boiler 10 ft. long showing 10 in. of water in the glass, when the ship is on even keel, the level, if the list to port is 15 deg. the boiler being set athwartship and the glass on the starboard side with the list to port, will be as shown in Fig. 1. In the figure X shows the drop of the water in the glass, L the length of the boiler. Then X will equal $\frac{L}{2}$ x sine of the angle of list and from a table of sines, in this case we find the sine of 15 deg. to be 0.2588. The length of the boiler is 120 in., so X = 120 × 0.2588 ÷ 2 = 15.5280 in. The water will then be 15.528 — 10 = 5.528 in. below the bottom of the gage. This answer is not absolutely correct, but is as close as can be worked out with the data given.

6. With a crank shaft 15 in. diameter and eccentric throw 5 in., if the crank were placed so the line of throw of the eccentric were at right angles to the center line of the engine, then the following statement will give the distance the valve will move, for ⅛ in. movement ahead of the eccentric on the shaft, assuming no lost motion: As 7.5 is to 5 in. so is 0.125 to X.

$$X = \frac{5 \times 0.125}{7.5} = 0.0833 \text{ in.}$$

(Also see accompanying diagram, Fig. 2.)

But when the crank is on the center, the eccentric line of throw will be somewhat lower than at right angles to the vertical center line, because of the usual angle of advance, so that the distance will not be quite as much as 0.0833 in. We may say 0.08 in. approximately.

7. If 2 or 3 bars fall down in a grate on which pea coal is being burned, close up space with anything comeatable and suitable; not with the idea of carrying fire upon that part again, but to stop the in-

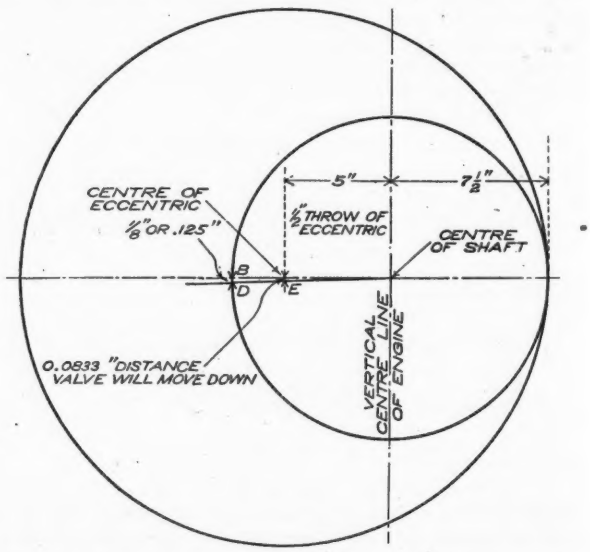


FIG. 2. FINDING VALVE MOVEMENT FOR A GIVEN ECCENTRIC MOVEMENT; VERTICAL ENGINE

flow of cool air which would rush in, if the space were allowed to remain open. Attending conditions would influence further action to be taken.

8. If one tube of a boiler let go and there were no tube caps, drive in a wooden plug, perhaps 2, one at each end, according to the location and extent of the leak. Pine plugs are preferable.

9. For an engine having a 42-in. stroke, with valve travel 10 in., with ⅛-in. lead, with a lap of 2 in. the distance of the cutoff from the end of the stroke will be found by this rule: Multiply the lap by 2 and add the lead and divide by the travel; square this and multiply by the stroke in inches. This gives (2 × 2 + ⅛) ÷ 10; square this and multiply by 42 = 7.14 in., the distance of cutoff from the end of the stroke. From the beginning of the stroke, it will be 42 — 7.14 = 34.86 in.

10. With steam at 60 lb. gage pressure and the clearance 5 per cent, in order to have the terminal pressure atmospheric, we should have that the initial pressure absolute is 60 + 15 = 75 and as atmospheric pressure is 15 lb. absolute, there will be according to the terms of the question, 75 ÷ 15 = 5 expansions. The point of cutoff is usually stated in terms of stroke, which means the apparent cutoff, and we desire to find the apparent cutoff in this case. The real cutoff which involves clearance, is (X + 0.05) ÷ 1.05 = 0.20

or 20 per cent, because of there being 5 expansions before found.

X equals the apparent cutoff which we are seeking; therefore by transposition of terms we have : $(1.05 \times 0.20) - 0.05 = 0.16$ or 16 per cent. That is, cutoff will occur at 16 per cent of the stroke from the beginning, in order to have 5 expansions and a terminal pressure of 15 lb. absolute. Of course, neither condensation nor radiation losses have been considered.

11. For 4 boilers with 3 furnaces each, 3 by 5 ft. $3 \times 5 = 15$ sq. ft. to each furnace. 3 furnaces $= 3 \times 15 = 45$ sq. ft. 4 boilers $= 45 \times 4 = 180$ sq. ft. grate total.

Assume 16 lb. coal consumed per hour per sq. foot grate surface. $180 \times 16 \times 48 = 138{,}240$ lb. coal burned for 2 days of 24 hr. each. At 2,240 lb. per ton, $\frac{138{,}240}{2{,}240} = 61.7$ tons closely, or $61.7 \times 42 = 2{,}589.4$ cu. ft. when expressed that way, allowing 42 cu. ft. to a ton.

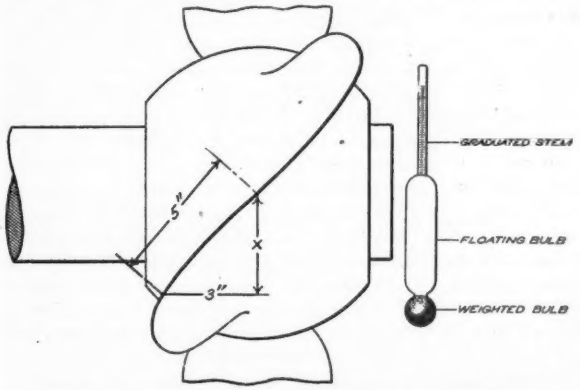


FIG. 3. FINDING PITCH OF SCREW PROPELLER
FIG. 4. USUAL FORM OF GLASS SALINOMETER

12. For an engine cutting off at 0.5 stroke, assume initial pressure to be 100 lb. up to point of cutoff 0.5 stroke, and leave clearance out of the calculation as no mention is made of it in the question. Assume the length of stroke to be divided into 8 parts. 0.75 of the stroke is at part 6, the pressure at part 4, or 0.5 is 100 lb., so that, at 0.75 or part 6 of the stroke the pressure will be $\frac{4}{6} \times 100 = 66\ 2/3$ lb. or 2/3 the initial.

13. Set a spring loaded safety valve by adjusting the spring under pressure according to the indications of a correct steam gage, so that the valve will blow off at the desired pressure.

14. For a semicircular tank 18 ft. 3 in. long and 16 ft. 6 in. in diameter, we have, 18.25 ft. = length; 16.5 ft. = diameter of the tank. Then $16.5^2 \times 0.7854 \times 18.25 = 3902.308 +$ cu. ft. for circular section, which divided by 2 gives 1951.15 cu. ft. in the semicircular tank. $1951.15 \times 62.5 = 121{,}946.875$ lb. water contained in the tank; and $\frac{121{,}946.875}{2000} = 60.97$ tons. Answer.

15. For a Morrison corrugated furnace, mean diameter 40 in. thickness 0.5 in., constant 14,000, the pressure allowed will be: $\frac{14{,}000 \times 0.5}{40} = 175$ lb.

16. With the propeller having a diameter of 12 ft. and a piece of pitch 3 ft. and a piece of screw 5 ft., we have the right triangle shown in Fig. 3. It is necessary to find the circumference of the outside of the propeller and also the length X in direction of this circumference. By the rule for a right angle triangle the side X equals the square root of $5^2 - 3^2$ and $5^2 = 25$, $3^2 = 9$ and the difference equals 16, the square root of which is 4, the side X. The circumference of a 12-ft. circle is 37.699 ft. and we then have the proportion as 4 is to 37.699 ft. so is 3 to the pitch of the screw, this giving the pitch at the tip of the blade. This worked out will give a pitch of 28.27 ft. If the pitch is desired at any other point of the blade, take the circumference at the desired point and substitute it in place of 37.699 ft. in the simple proportion as given.

17. Travel of valve divided by 2, minus lap equals greatest opening for steam. Greatest opening for steam times length of port equals port area. For 7 in. travel, 1.5 in. lap and ports 2.5 by 20 in., $\frac{7}{2} - 1.5 =$ greatest opening $= 2$ in., and $2 \times 20 = 40$ sq. in. port area.

18. Piston valves are used for high-pressure cylinders, because of the balancing effect, which reduces frictional resistance to a minimum. D valves are used (double or even triple ported) for low-pressure cylinders, because the low pressure does not require a balanced valve. The D valve is not so costly to make or maintain, and it takes up less space in a fore and aft direction than will a piston valve. The double or triple ported valve will permit the required quantity of steam to enter the cylinder quicker than would a piston valve. Piston valves increase the clearance spaces, and require long steam passages, which in the case of low-pressure cylinders would not quite do because of condensation losses. There is no trapping of water with D valves, as might happen with piston valves.

19. We regulate density of water in a boiler by changing the water according to the indications of a salinometer, hydrometer, and thermometer, by "blowing down" as the method is termed.

A salinometer is an hydrometer particularly adapted to measure the saline matter in water, hence the name. It is an instrument made of brass or glass and consists of a hollow bulb with a graduated stem attached to its upper end, and another weighted bulb at the bottom end to keep the instrument upright in the water when in use. The graduations are made for different degrees of saltness of water. Some salinometers have 3 different scales of graduations, to suit 3 different temperatures, namely 190, 200 and 210 deg. F.

Salinometers are graduated by trial; first in fresh water of a certain temperature, and marked at the depth to which the instrument sinks. Then placed in water containing 1/32 part salt, and the same temperature as the fresh water was, and so on, up to 12/32 parts salt.

A thermometer is a hollow glass stem with an enlarged bulb at the bottom end which contains mercury or quicksilver. This stem is placed beside a graduated scale which indicates the degree to which the mercury has risen in the stem, and the intensity of the heat to which the thermometer is subjected.

20. Evaporating 8 lb. of salt water will leave 0.25 lb. or 4 oz. of salt speaking in general. But ordinary sea water contains, on an average, 1 lb. of solid matter, about 0.25 of which is salt; so in the strict sense

of the question, in every 32 lb. water, there will be but 1 oz. or 1/16 lb. of salt.

21. When running a jet condenser in a seaway, take care that the condenser does not get hot when the ship rolls the injection strainer out of the water. Have a hose ready to flood the condenser externally. When stopping and starting the engine as when coming alongside the dock, take care that the vacuum is ready to operate and so prevent the condenser flooding, as might otherwise occur.

Maximum density of water carrying a boiler will be $\frac{1\frac{1}{2}}{32}$ to 2/32, although some authorities allow 5/32. Saturations of the water in the boiler should be taken by using a salinometer, pot and a thermometer with samples drawn from the water in the boiler. From water drawn from the boiler and when cooled at 200 deg. Fahrenheit thermometer, the salinometer is put in the water and should it read more than 3 on the scale it is time to blow down. Suppose that the reading was 4/32, then amount to below down is determined by subtracting one from the numerator of 4/32 and then using the remainder as the numerator of a new fraction having 4 for the denominator. Thus $4 - 1 = 3$ and $\frac{3}{4}$ equals the amount to be blown out of the boiler.

NEWS NOTES

On Septemrer 1st, Henry A. Pastre was appointed special representative of the Liberty Mfg. Co. and will travel from its Main Office, 6905 Susquehanna St., Pittsburg, Pa.

Chas. M. Gilbert, who for the last 3 yr. has been chief engineer for the Washington Brewing Co., of Columbus, Ohio, has resigned his position to accept one with the Keystone Lubricating Co. of Philadelphia. Mr. Gilbert is well known in N. A. S. E. circles, having been a delegate to a number of National Conventions, and has served the Ohio State association both as treasurer and secretary, as well as being president of his own association for 4 successive terms. He was also chairman of the local Convention Committee at Columbus. While his many friends regret seeing him leave Columbus, they at the same time wish him success in his new field of labor.

Mr. Gilbert will travel over the entire state of Indiana, with Indianapolis as headquarters.

The United States Civil Service Commission announces an examination on October 20 and 21, 1909, to secure draftsmen for the Patent Office at Washington. The age limit is 18 yr. or over and the salary $1,000 a year. The examination will cover the following subjects with weights as indicated: Arithmetic, 5 per cent; lettering and shading, 20 per cent; perspective drawing, 20 per cent; drawing and specifications, 35 per cent; training and experience, 20 per cent. Circular number 541 describes the particulars of this examination and applicants should apply either to the Civil Service Commission at Washington or to the nearest office where the examination will be held for Form 1312.

The Philadelphia Electric Co., after careful investigation and test has just placed an order for 34 500-hp. Taylor Gravity Under-feed Stokers with the American Ship Windless Co. of Providence, R. I. These are to be installed in the Christie St. plant.

The fire which occurred in the Cincinnati plant of the S. Obermayer Co., Sept. 11, merely damaged the warehouse; no damage was done to its various manufacturing departments. Patrons will be glad to note that there will be no interruption in business and orders will be filled with the same promptness and dispatch as always

Allis-Chalmers Co. has received a contract for the construction of the largest city pumping engine in the world. The engine is to supply water for the city of Wheeling, W. Va., and is of the triple expansion, crank and flywheel, standard Allis-Chalmers make. This is the largest pumping engine used to supply water to a municipality, the low pressure cylinder of which will be 110 in. in diameter by 72 in. stroke. The engine will have a capacity of 20,000,000 gal. a day, and will have to pump against a regular domestic water pressure of 150 lb. per sq. in. There will be 2 20-ft. flywheels weighing 100,000 lb. each. The total weight of the engine will be about 2,225,000 lb.

The Hoyt Electrical Instrument Works have bought a piece of land, fronting 100 ft. on Main St. Penacook, N. H., which forms part of the Central Trunk Boulevard, being built through the White Mountains, and will erect a modern fire-proof garage and salesroom. The wide-spread demand for Hoyt meters having made it necessary to devote the entire Washington St. plant to their manufacture.

E. W. Carter, who has for some time past been in charge of the Boston office of the Hoyt Electrical Instrument Works, will hereafter be connected with the factory, and A. K. Brown will succeed him in charge of the Boston office. Mr. Brown has been identified with Hoyt instruments for a considerable time, and is therefore well equipped for his new position.

Contracts have been let by which the American Steam Pump Co. will furnish 18 simplex steam pumps for the new Blackstone Hotel now being built in Chicago.

The American Supply Men's Association, connected with the American Order of Steam Engineers, is evidently in earnest in the effort that is being put forth to make a decided success of the exhibition which will take place in conjunction with the annual session of the Supreme Council, American Order of Steam Engineers, to be held in the I. O. O. F. Temple, Broad and Cherry Streets, Philadelphia, during the week beginning June 6, 1910. Chas. A. Hopper of The Keystone Lubricating Co., who is president of the American Supply Men's Association, and Clifford P. Williams with John R. Livezey, who is director of exhibits, with the able assistance of the executive and exhibit committees, have about completed the preliminary work, and state that the exhibition of 1910 will eclipse all former efforts. Also the local councils of the American Order of Steam Engineers have entered heartily into the work and have appointed the following convention committee, which has organized as follows: Lewis Schlihner, chairman, Germantown Council No. 22; A. K. Wright, vice chairman, Camden Council No. 3; William Parent, secretary, Philadelphia Council No. 7; J. W. Clark, treasurer, Camden Council No. 3; William J. Donavan, Jacob Earney and Geo. Kennidy, Kingston Council No. 3; Wm. J. Gifford, Hugh Ryder and Chas. Meyer, Southwark Council No. 4; Wm. Parent, M. Holmstiedt and C. Munsey, Philadelphia Council No. 7; Geo. Arnold, A. Roberts and Geo. Richardson, Manayunk Council No. 9; Fred Markoo, Daniel Bunting and Wm. Getz, Municipal Council No. 20; Lewis Schlihner, Oscar Kurtz and Wm. Weyant, Germantown Council No. 22; A. K. Wright, J. W. Clark and Jos. Whiley, Camden Council No. 3.

With reference to rumors recently circulated, to the effect that large shop and foundry extensions are to be undertaken this fall by Allis-Chalmers Co., it has been authoritatively stated by President W. H. White-

side that no further additions to the West Allis Works are contemplated. An extension, however, to the Cincinnati works of the company is being made which will give employment to about 1,000 additional men. Construction work and the installation of new equipment was commenced there some weeks ago.

THE MONTH OF AUGUST has been the largest in the history of the Burt Manufacturing Co., which extends over a period of 17 yr. The fact that it had unfilled orders on its books amounting to nearly 40 per cent of its entire output for August is an indication of the wonderful improvement which has taken place in business during the last few months. This is a remarkable showing, taking into consideration that many lines are not, as yet, up to their normal conditions.

JOHN W. GOOD, a prominent and well known business man of Dayton, Ohio, has been elected as treasurer of the Lucas Pump Co. in place of R. E. De Weese, who has resigned and will take a trip abroad.

TESTS ARE BEING MADE at Brant Rock, Mass, of the wireless telegraph apparatus to be installed at the 1,000-ft. tower to be erected at Washington. The Navy Department specifications require that it shall be sufficiently strong to send messages 3,000 miles and receive them from the same distance.

FOR THE PURPOSE OF HOLDING PRICES up to a point where manufacturers can make actual cost and a reasonable profit, for doing away with unfair competition, for encouraging high quality in manufactured articles, the American Supply & Machinery Association has been organized and is carrying on a campaign for this purpose. It has received the hearty approval of two of the organizations of supply and machinery dealers, the National Association and the Southern Association, both of which have adopted resolutions endorsing the American Association and its principles.

THE PITTSBURG FEED WATER HEATER CO. announces that it has recently been reorganized and the following officers have been chosen for the coming year: E. D. Graff, president; J. E. Schlieper, vice-president; Jos. F. Guffey, treasurer; C. E. Greenfield, secretary; S. S. Stewart, sales agent.

THE ALLIS-CHALMERS COMPANY OF MILWAUKEE, Wisconsin, has entered the field as manufacturers of machinery for sand lime brick and has employed as commercial engineer, Franklin Henshaw, an engineer of wide experience in this line and formerly associated with the International Sand-Lime Brick Company of New York City.

F. H. BANBURY, ENGINEER of the Acheson Oildag Co. of Niagara Falls, sailed for Europe on the Steamer St. Louis, Sept. 25. Mr. Banbury is an Englishman by birth. He came to America about 5 yr. ago and was connected with the Commonwealth Edison Co. of Chicago. It is his good fortune to have won degrees as a mining, mechanical and electrical engineer. It was a little over a year ago that he became connected with the Oildag Co., and now he goes to Europe in the extended patent interests of that company. He will first go to Genoa, Italy, later visiting other countries to establish the Oildag process as demand makes necessary. Inasmuch as Dr. Edward G. Acheson is president of the Oildag Co. and it was he who gave the world Deflocculated graphite as a lubricant, Mr. Banbury's mission in Europe may be adjudged to be one that will enlighten foreign countries to a considerable extent as to the merits of the wonderful lubricant Dr. Acheson has given the world.

KEYSTON CHEMICAL MFG. CO., which since 1883 has been engaged in the business of manufacturing and installing apparatus for the purification of water and whose home office is in Philadelphia, has recently established a branch office in Chicago, in charge of E. B. S. Meyers, who will look after the interests of the company in the western territory. Mr. Meyers has had long experience in this field of water purification and is enthusiastic over the savings possible by preventing the formation of boiler scale and by keeping impurities out of the boiler. The system has the advantages of treating the water chemically and afterward purifying it by filtration, the passage through the filter being under pressure in a closed filter, so that the disadvantages of large space and objectionable odors which come with the use of a gravity filter system are avoided and a comparatively small installation can be used. Plants are made with capacities of from 500 to 15,000 gal. an hour, covering the range from the smallest plants to the largest. The Chicago office is in Room 648, First National Bank Building, and all communications from the western territory should be sent to the Keystone Chemical Mfg. Co. at this address to make sure of prompt delivery.

E. B. SHOWELL MEYERS, CHICAGO MANAGER KEYSTONE CHEMICAL MFG. CO.

THE COMMONWEALTH EDISON CO., of Chicago, has completed plans for a new extension to its Quarry Street station, which will cover 200 by 220 ft. and without machinery will cost about $400,000. Figures are now being taken for the work on the building. The complete plant will consist of the Fisk Street station, which has 10 turbines, and of the Quary Street station with 8 turbines, all of the Curtis type, made by the General Electric Co.

EXAMINATION WILL BE HELD on Oct 27 for Teacher of Mechanical Drawing in the Indian service, the examination to be on arithmetic and computation, drawing and shading, and drawings and specifications; the first subject to count 10 per cent, the second 40 per cent and the third 50 per cent in rating the answers.

Salaries for this work range from $600 to $840 a year, and applicants must be 20 yr. of age or over. Application for forms 304 should be made to the U. S. Civil Service Commission, Washington, D. C., and in time to allow shipment of examination papers to the different cities where examinations are made.

Further information can be had by getting No. 552 information blank from the Civil Service Commission.

FOR DOUBLE BELT 1 in. in width should be allowed per horsepower at a speed of 1,080 ft. a minute. The power will increase directly as the width of belt and the speed. The speed for maximum economy is 4,000 to 4,500 ft. a minute, but main driving belts often run faster.

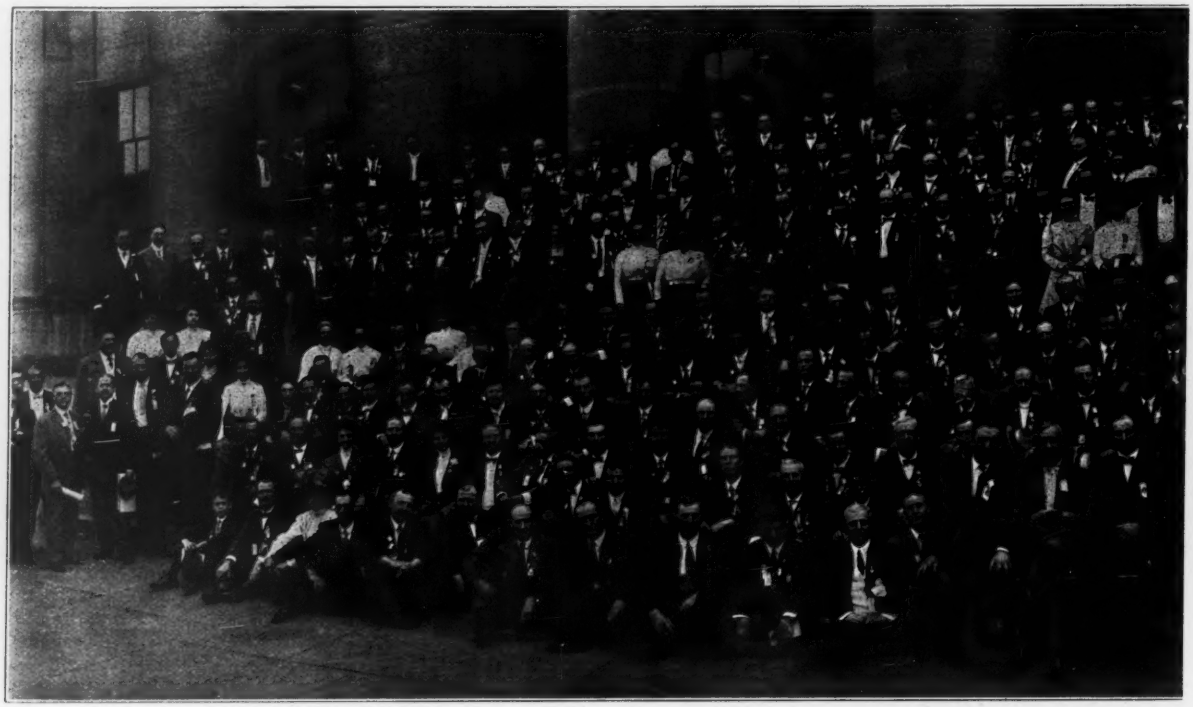
COLUMBUS NATIONAL CONVENTION OF ENGINEERS

As a Delegate Saw It, September 13-17

WELL, you know the 13th was mostly given to getting ready anyway, and I had a lot to do to get the plant in shape for my assistant and a cub fireman to keep running for a week, so I didn't start until Monday morning, and then I got in there just about dusk Monday, just as the lights had been turned on. The Columbus station is just as smoky and dirty as most railway stations, but when you got out on the street that line of arches of lights down High street was certainly an inviting proposition, and it looked as if all Columbus was turned out to welcome us.

We were taken in hand by the local committee with that band, and it surely was a cheerful greeting they gave us. It was some considerable tramp from the station down to the hotel, but it was good preparation for the week, because we had to keep tramping all through the week from hotel to meetings and meetings to exhibition and then back to the hotel again. Somebody said that it was "a convention of magnificent distances," and that just hits the mark.

Well, we got down to the hotel and they had just finished the meeting of the Ohio State Association and all the big fellows from Ohio were there with a lot of big ones from other states. There was Judson Pratt, from Cincinnati, and he had just put through the state convention his pet resolution that the badge of the National Association ought to be red, white and blue and had the backing of the state convention to present this to the national convention. And then there was W. V. R. Coon, the secretary of the state convention, who was looking worn from trying to keep up with putting all the Ohio state business through in one day; and E. C. Johnson, the past president of the Ohio state, who had been having a sweating hot time keeping the delegates together and in order; and all the new Ohio officers: F. E. Brammer, of Ironton, president; Harry E. Eichhorn, of Columbus, vice-president; J. J. Ahlers, of Cincinnati, secretary, and Volney Weatherford, of Cincinnati, treasurer. They had had a fine meeting, and besides discussing some changes in the Ohio license law, which were finally laid on the table, they had addresses from Dick Pape, the Pennsylvania state treasurer; from Bob Ingleson, past national president; from Editor John Lane; from A. L. Case, president of the New Jersey State Association; from National Vice-President Reynolds, and from Chief Examiner Kennedy, of Ohio. There had been some objection to the new rulings in regard to the examination of engineers in Ohio, but Chief Exam-



GROUP OF DELEGATES AND GUESTS IN

iner Kennedy was able to explain why these rulings had been made, and when he got through the members were of the opinion that he was all right.

The convention had decided to meet in Hamilton next year, and the new officers were installed in due form by Past National President Fehrenbatch. They had done a mighty good day's work and all the Ohio fellows were feeling fine and looking forward with great anticipation to the national work.

There were a lot of the big fellows from the other states, too. There was Heeger, of Indiana, who was the whole thing in making the Evansville convention a success; and there was Osborn, who has been state state secretary for Connecticut for a good many years; and Lee, of Albany, N. Y., one of the national trustees; and Dan Hussey, of New York City, who is always at national conventions and is one of the best pushers in the lot; and Bill Cronley, of Jersey City, was there—he always is; and there was W. W. McLean, from the Bean City, another of the trustees; and T. N. Kelsey, from Lowell, Mass., who bears up as one of the past national presidents; and there was E. T. Rose, from Detroit, and Aaron Miller, from Kalamazoo, who have been wheel horses in Michigan for years; and Royal Tomlinson, who was from New York but ought to have been from Milwaukee; and the Colorado fellows were right in the push, too, with Carl Pearse, of Denver, who finally won out as vice-president; and F. S. Templeton, of Denver, who was the "man behind the gun"; and Holmes, of Cripple Creek, which is the place where they recently pulled off a state exhibit and convention that would have made some of the easterners open their eyes.

It certainly was a mighty fine lot of fellows to be with, and they were fellows who had been doing things all over the country. That was the reason they were there, of course.

We stayed around talking association matters, figuring on who were likely to be the next national officers and how the publication contract would go, and a lot of other things, until about 8 o'clock, and then we started for the exhibition hall. Some fellow said it was just around the corner, and it certainly was around the corner, but after you got around, there

ATTENDANCE AT THE COLUMBUS CONVENTION.

Lawler, from Buffalo, who makes all the Buffalo boys stand around; and L. L. Ketchum, of Madison, Wis., who is the father and chief sponsor of the Wisconsin idea of extension education; and W. E. Hill, of Illinois, who is the hard worker of the Illinois State Association and was one of the big factors in pulling the little Moline association up to second place in the educational contest. And, of course, there were the big fellows from Chicago: Tom McNeill, who is president of No. 1; John Moore, who is secretary, and Jake Reitz, who helps the two of them run it. And there were A. L. Hadin and Charlie Naylor, of Illinois 28, and John McGrath, who forms the third of the big trio of that association. And then there were the Indiana fellows: J. C. Carter, state president, and E. C. Dietrich, from South Bend; and there were Ed.

wasn't any "just" about it; it was a good half mile. And hot! Well, you had to spell it in capitals and double spaces to get any idea of what it looked like. It was worth while, though, when we got there, for the exhibit was certainly a dandy. The finest layout you ever saw, and with a really artistic scheme of decoration that had been carried out all over the hall, so that there weren't any yellows and purples in one one booth swearing at blue and greens in the next one and with black and white on each side to make the whole thing look a mausoleum. The bright red made it feel a little bit hot on a hot night, but then, the whole thing was so good that it would be a shame to criticize even in this respect.

They had a little opening doings, but for the most part we stood around Monday night and talked with

exhibitors and looked things over in a general way and decided what we would do the rest of the week.

It was no use to try to see all of it, because a man would have had to spend the entire week, every day, in order to look over the exhibit thoroughly, so you had to pick out what you wanted to see most and put in your time on that. I won't try to tell you here about that, as another fellow had the job of getting a complete description of it, and I am glad I didn't have his work to do, for he certainly must have had his hands full.

They had some kind of reception at the hotel for delegates and guests, but it was mostly a ladies' affair, for the fellows were all over at the hall. It was lucky there weren't any late doings on Monday night, be-

FRED J. FISHER, PRESIDENT OF THE N. A. S. E. DURING THE CONVENTION.

cause they didn't let us get to bed early the rest of the week, and we certainly needed that one night's sleep for a starter.

Tuesday

I went over to the hall Tuesday morning early and thought I would have a chance to look around some before the convention, because that didn't start until 10, and I had a lot of looking to do. I got so interested in studying some of the things there that I didn't get over to the convention hall until 10:30, but they were a little late, as usual, in starting, so that I got in all the speeches after all.

Of course, we got welcomed to the city. We always do, and it is a good thing to do, but the fellows this time showed mighty good sense and didn't make the speeches long ones; in fact, it was so hot that by the time a fellow had talked 10 minutes he was a good representation of a running river, so that no one felt like using more than his allotted time.

Chairman Gilbert of the local committee presided and spoke of the convention 12 yr. ago and of the growth of the city and of the association since that time. He introduced Governor Harmon, who was greeted royally by the delegates and paid back in kind with a royal tribute to the work of the engineers and their standing in the community, advocating co-operation among men of the same craft and the progressive spirit for which the association stands. National President Fisher replied, acknowledging that the governor had given as warm a welcome as even the traditional western hospitality could extend. He spoke of the high place that Ohio has taken in national affairs through the presidents it has given the country, and gave a brief history of the work of the association since its formation, and congratulated the members on the freedom which had been maintained from entanglements in labor disputes.

Past President Carney was then called on and spoke of the last Columbus convention, of the fact that the membership had doubled since 1897, and that the standard of efficiency of engineers had increased at even a greater rate. He mentioned the increase in the size of power stations, increase in responsibility of engineers and the outlook for the betterment of the engineer's position and pay as this concentration goes on.

Mayor Bond was unfortunately absent, but in his place Geo. S. Marshall welcomed us to Columbus, speaking of the rank which the engineer takes as an educated man and of the increasing importance of the profession of engineering as our lives become more and more dependent on machinery.

National Vice-President Reynolds, of New Jersey, accepted this welcome, and National Secretary Raven read a cablegram received from London from former National Vice-President Chas. F. Hart.

Committees were then appointed for the convention and adjournment was taken until afternoon, when the report of credentials showed the presence of 354 delegates, and the address of the national president was delivered. President Fisher, while agreeing with his predecessors in regard to the necessity of much work by the president and vice president, could not see that the appointment of district presidents would be of avail, but urged that corresponding secretaries ought to make prompt reports to state deputies so that they in turn might report to the national vice president, otherwise the reports to the National Convention become largely a farce.

The financial year has been good, the treasury showing satisfactory condition, although it was nearly depleted after the Denver convention. President Fisher emphasized the importance of having a good live state association in every state, as the enthusiasm coming from these state meetings and the assistance that the state association can give to locals is of the greatest importance, perhaps even more than the National convention. The report of the national secretary showed that 11 new associations had been added to the roll during the year and 8 had disbanded, most of the members joining nearby associations. The membership, as shown by the reports at the present time, is 19,500, and the number of associations 362. New York, Ohio, Massachusetts, Pennsylvania, Illinois, New Jersey and California are the leading states in the order given in the number of members, and the largest associations are Illinois No. 1, of Chicago, California No. 2, of Los Angeles, Ohio No. 15, of Cincinnati, Pennsylvania No. 15, of Pittsburg, Colorado No. 1, of Denver, and Illinois No. 28, of Chicago, while New York No. 24 is a close seventh.

The treasurer's report showed a balance on hand of $18,468.88, with all bills paid. The educational committee, of course, reported, and they showed that the course on gas engines and gas producers as taken over from the Wisconsin University Extension Courses had been favorably received, although they seemed to think that it was not as universally well liked as something on steam engineering would have been. In the contest on answers to educational questions, Illinois No. 28, of Chicago, won out for first place with a record of 98 per cent, and Illinois No. 17, of Moline, got second place with 97.29 per cent, while Massachusetts No. 17, of Lowell, got third prize with 96.79 per cent. It was a little hard lines on Colorado No. 6.

of Pueblo, for their percentage was 96.75, and then Indiana No. 15, of Evansville, had 96.20, so that the contest was a pretty warm one right around third place, anyway. It certainly is a mighty fine showing that 10 associations had 91 per cent or better in a percentage of correct answers, and proves what good work is being done throughout the country.

License laws are one of the things that always interest engineers. I never saw an engineer yet who hadn't an opinion on the subject,—either was hard for it or hard against it, according to how his experience happened to run, and the report of the license committee was pretty strong indication of which way the wind blows in most places. They said that replies from the state deputies all over the country showed that where there are no license laws a good strong effort is being made in most instances to get one and the only complaint that seems to have any real basis

been secretary-treasurer of the department, and the appointment of Geo. F. Schofield to fill the unexpired term. He told also of the condition of the reserve fund and showed by the secretary-treasurer's report a membership of 2,886 in the L. & A. Department and a balance on hand in the benefit fund of $235, in the expense fund of $1,026.96, and in the reserve fund of $3,312.73.

There was a lot of discussion on one thing and another about how things ought to be managed and about the office of secretary and his salary, but the whole thing worked out by finally putting the treasurer's bond at $7,000 and the salary at $900 a year, and the election of J. Douglas Taylor, of New York City, as secretary-treasurer. It took three hours to settle it and any number of ballots, but after the smoke cleared away everything was peaceful and everybody went away happy, even if hot.

NEWLY ELECTED OFFICERS OF THE N. A. S. E.

W. J. REYNOLDS, PRESIDENT F. W. RAVEN, SECRETARY S. B. FORSE, TREASURER.

where a license law is in force is that in some cases examiners have been appointed for their political "pull" and not for what they knew. Like any good law, poor enforcement of it makes it unsatisfactory.

Evidence goes to show, however, that where such laws have been passed there is a reduction of accidents and that employers after a short time are generally favorable to such laws, also there is a tendency all along the line in states where engineers must be licensed for the wages to come to a higher level.

They reported that license laws are now in effect in Massachusetts, Montana, Minnesota and Ohio, and that cities having local license ordinances are: Allegheny, Atlanta, Baltimore, Buffalo, Chicago, Denver, Detroit, Hoboken, Goshen, Jersey City, Kansas City, Lincoln, Los Angeles, Memphis, Mobile, New Haven, New York, Niagara Falls, Omaha, Peoria, Pittsburg, Philadelphia, Rochester, Santa Barbara, Saginaw, Scranton, St. Joseph, St. Louis, Sioux City, Spokane, Tacoma, Terra Haute, Yonkers, and Seattle.

Near the close of the session this afternoon G. J. Gibney, of Mobile, Ala., on behalf of the association from that city, presented the president with a handsome gavel having a suitable inscription on the silver plate. Adjournment was then taken until next morning.

The day's work was not done, however, for that evening the Life and Accident Department had a meeting and it was one of the hottest sessions in the whole week. The report of Chairman Beckerleg told of the death of Ira Watts, who for a long time has

My side partner for life, who came along to keep me straight through the week, because she didn't think it was good for a man to be alone at such a place, said the ladies had had a good time all day with an auxiliary meeting in the afternoon, at which they had some music and appointed committees and where some souvenir spoons were presented from the Illinois associations to National President Mrs. Weaver. They then adjourned until Thursday morning and in the evening, while we fellows were smoking over the election, they went down to hear a ladies' minstrel show by a Columbus organization that's a crackerjack. Of course, the fellows that didn't have to go to the meeting as delegates were over at the exhibit hall, taking things in and having a good time. They had a concert by the Newsboys' Band, which is made up of fellows who work for the Columbus Dispatch, and it was a concert worth going to. It showed that the Dispatch fellows could toot as well as holler, and it kept the fellows there until the lights went out at 10 o'clock. But then, we fellows had all the fun of a good fight and I got time next day for a good study of the exhibits while the other fellows were still in bed.

Wednesday

When they laid out the convention, Wednesday was allowed for a holiday, but you can't make an engineer stop working, even when he has the chance, so when the fellows adjourned on Tuesday afternoon they wouldn't hear to it and just adjourned until Wednesday morning. There were a lot of trips to

make about the city Wednesday, but we all got together along in the forenoon and heard some committee reports and attended to a lot of detail that would have been in the way Thursday if we hadn't done it then. The trustees handed in their report, telling about what the paper had done during the past year, showing a balance of $7,500 left from the earnings after the expenses of trustees and of the editorial department had been paid. They reported also the receiving of bids for the publication of the paper in the future, which were presented to the convention by the secretary on Thursday.

The final report of the credentials committee showed 364 delegates who were promptly seated and then the convention adjourned and we went over to the pumping and filtration plants, which were certainly big fellows and well worth careful study. I won't tell you about this because it would take too much space, but they have got 3 engines there of 20,000,000-gal. daily capacity, that can run up to 25,000,000 on a pinch, and a couple of 100-kw. generating units and a couple of 20,000,000-gal. daily capacity centrifugal pumps for the filtration plant. They have also a 3,000,000-gal. fire pump and other machinery to make out a complete plant of that size.

That afternoon most of the fellows went out on a trip to a park way out north of the city, where they had the regular summer amusement park things, and everything was gratis to delegates and visitors, but I could see that kind of thing most anywhere any time, so I stayed around the exhibit hall and talked with the fellows there and loaded up with souvenirs and catalogs. My wife says that if I don't quit that she will have to carry her dresses home in a bundle, but I told her my catalogs were just as important as her dresses and they didn't take up much room anyway, so we will have to squeeze the lace a little tighter and let it go at that.

Everybody got back in the evening and they had an organ recital and lecture over at the hall. The organ recital was good and they had a good orchestra, and the lecture was all right in its way and deserved better treatment than the boys gave it, although I think that it was a little bit of a mistake to put it on in just the form that it was done. Of course, having my better half along, I thought it was better not to go to the smoker Wednesday evening, and was glad afterwards that I didn't. The fellows who went said they were sorry they did, and it seems too bad that anybody should think that the engineers were the kind of a crowd that would enjoy that sort of a thing. It's all right to go off and have a good time and nobody objects to a quiet little mill on the side, but the fellows who go to these conventions are most of them a good deal like myself, who have a good deal of self-respect and don't care to lose it. It seems to me that there ought not to be anything at these conventions to make a man wish afterwards that he hadn't been there. I don't know whose fault it was and it don't matter much, only it seems to me somebody ought to be ashamed.

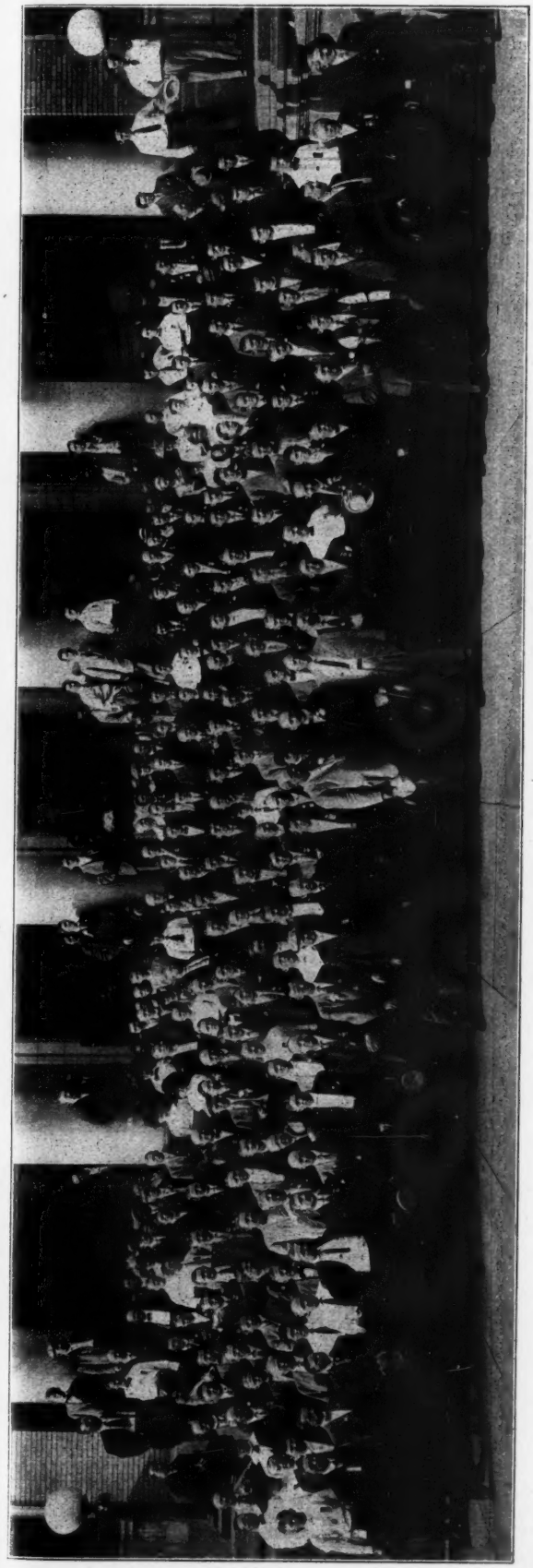
Thursday Morning

Now, Thursday was the day we did things. Thursday always is the big day of the convention and this time it was bigger than usual, because there were 2 mighty important matters to settle. Of course, there were a lot of others, but there were 2 that stood out and about which everybody had been talking all week. They were the publication contract and the place of meeting for 1910. But that is getting ahead and what we did will show up in time.

We got together in good season on Thursday morning and took up the report of the constitution committee. All they said was that a committee ought to be appointed to revise the constitution and embody provisions for paying tax on associate members, provision for revising state deputy charter decisions, and provision for taking care of members in good standing of an association which is suspended. The report was tabled for the time being and communication was received from the exhibitors requesting that in providing for the place of meeting 4 requirements should be considered. This report was just a suggestion and not in any way intended as a demand. They asked us to see that any city bidding for the convention guaranteed first a suitable auditorium for the meetings; second, standard hotel rates which should not be increased at all from regular rates; third, sufficient accommodation for exhibitors to arrange and show their goods; and fourth, the necessary badges for the convention. These certainly all looked like reasonable provisions and the committee on ways and means, to whom it was referred, were glad to take them into account in their report.

Of course, there were a lot of changes in bylaws and constitution that have been proposed by various associations and there was considerable talking back and forth one way and another, the outcome of the whole matter, leaving out those things which were defeated, being that the committee on such matters advised that the secretary ought to get together all amendments proposed and submit them to the next national convention and then that all which were found suitable for referendum should be sent out to the subordinate associations on or before Oct. 15 following. Any amendment which doesn't seem clear may be changed in the wording or corrected by the convention and then referred back to the association which sent it in for concurrence or alteration.

We fixed it so that nobody could hold an office in the convention who was not an officer or a regular delegate or alternate, and nobody could hold more than one office at a time. And we fixed it so that associations could not be formed just for the purpose of sending delegates to the national convention; they have to be formed before the first of March preceding the convention in order to be represented. And we safeguarded the treasury by providing that no money can be paid to anybody except in the regular way through the order of the secretary drawn on the treasurer. Then the power plant has grown so and includes so many things besides steam that we changed the admission requirements to allow anyone from a power plant to come in, instead of just the fellows from steam plants, which lets in the gas engine and hydraulic and electric power plant men. There were a few other things, but they weren't of great importance, and we then got at the pension fund report. The pension committee had done a lot of good work and tried to fix up a constitution which would keep a pension department running and provide for a $10 a month payment to those who are actually disabled. Any man who has been in the association 5 years or over would be eligible to this pension, provided he had kept up his membership payments all the time. All active members of the association are members of this pension department and the committee proposed to make the per capita tax 25 cents a year as a starter to see how things worked out. Of course, they are to have trustees to look after things and a secretary-treasurer to do the work, and a fellow is to take a physical examination by a good doctor before



EXHIBITORS REPRESENTATIVES IN FRONT OF MEMORIAL HALL.

the pension will be granted. They put this on the table a little while and looked at one or two other things, and then took it up again and Mrs. Moore, the national vice president of the Ladies' Auxiliary, talked to us about what they were trying to do in this pension fund matter and urged that it should be put through, and the per capita made at least 50 cents a year, so to build up a reasonable sized reserve fund. Some of the fellows couldn't see their way quite clear in this matter, so we gave a vote of thanks to the Ladies' Auxiliary and referred it to the committee on ways and means.

Then the Ohio State Association gave us its welcome to the Buckeye state and put up its annual recommendation that a red, white and blue button should be adopted instead of the standard black and gold. Nobody seemed enthusiastic and the matter was dropped. Everybody was glad that there were enough funds in the treasury to pay the full mileage of 5 cents a mile, for the railroads and the interstate commerce commission managed to fix it so that the delegates had to pay full fare both ways, coming and going, and all of us needed all the mileage we could get in order to get home without walking.

That was all of Thursday morning's work, and in the afternoon we got at the publishing contract and pulled and hauled on that a while, then finally did the only thing there was to do and awarded the contract to L. L. Rice, of Philadelphia. This contract runs for 5 years and provides payment of 20 per cent of the gross receipts from advertising into the treasury of the association, and we felt as if we had done a pretty good stroke of business in getting it in that shape.

We decided it would be no use in trying to revise the constitution just now and then we got after the convention city. There were Niagara Falls and Mobile, Rochester, Put-in-Bay, and Atlantic City all bidding, and the only places that stood any show were the first 3. Everybody thought that it stood between Niagara Falls and Rochester, and when Mobile showed up on the first ballot only 6 votes short of winning it certainly was an astonisher; but on the second vote Niagara Falls, which really wasn't in the contest, dropped out and those voters went over to Rochester, giving the convention to that city. By that time it was nearly 6 o'clock and we shut off steam for the day, banked fires and went out to see what we could find.

Of course, we headed first to the hotel, because that's where they fed us, and then in the evening they had all kinds of stunts at Memorial Hall, where the exhibits were, and we spent the time over there. It was a great show, all right, even if it was more or less impromptu, and the fellows all proved that if they couldn't make a living at selling steam supplies they could go into theatricals and win out that way.

Columbus Dill, of Ashton Valve Co., was chorus master, spite of his 98 or 97 odd years more or less. and was active as the rest of them. Van Tassel, of Westinghouse Machine Co., who carries the alphabet in front of his name, was master of ceremonies and general announcer. Too bad they didn't make him do a stunt, for he is a good one. Dan Cubberly, of Geo. B. Carpenter & Co., from Denver, who was down on the bill as tragedian, gave his song and story, and they might call it tragedy in Denver but it was good enough fun in Columbus. Jack Armour, of Power, did his regular and welcome turn, and Herbert Self, of Peerless Rubber Co., and F. X. Pund, of D. T. Williams Co., sang between times. A. G. Langenohl of

Mound Tool & Scraper Co. gave an unique and remarkable exhibition of what can be done with a drum. They were all so good there is no use in trying to give any one special praise. Whoever wrote and got up the final "drayma" ought to be in the professional end of playwriting. It was a timely hit called "A Dash to the Pole" and consisted, as most scenic productions do, largely of the properties and of the noise the audience made, but everybody got good fun out of it, and that's the main point.

Friday

By Friday morning we were all pretty well tuckered and were glad that there wasn't much on hand for that day. Most of the work was out of the way and the election of officers was practically the only thing left. There was a nice little contest in regard to the vice presidency but that was the only thing which caused any disturbance. Of course, W. J. Reynolds, of New Jersey, was elected president, as the custom is, and after the ballots were counted up, C. S. Pearse, of Denver, was found to be the new vice president. It was a good live contest and the man whose friends worked hardest won out. Fred Raven was continued as secretary, which was a mighty good stroke of business, and S. B. Forse, of Pittsburg, re-elected treasurer. A. C. Strickland of Richmond was chosen conductor and G. J. Giboney of Mobile doorkeeper, while W. W. McLean of Boston was re-elected trustee. So that was all there was to the convention.

We adjourned till evening and then the fellows from the big towns had on their "claw-hammers" and white linen and we installed officers and those that like to dance did that until they had to run for their trains. Some stayed over, but almost everybody got away before midnight.

It was a fine convention and we all had a good time. The last 2 days were comfortable so that we sort of forgot about the terrific hot spell in the first part and everything that looked like a squabble seemed to simmer down into a peaceable kind of contest and get itself settled to everybody's satisfaction.

Even though the ladies couldn't get the pension fund going this time, they kept up a tag day proposition through the week and managed to raise about $100 for the fund, and at a meeting Friday afternoon, which was a sort of after-thought, the money they had on hand for the building of a home, which amounted to $4,680, was taken over and will be held in trust to await further development. Of course, we all had a mighty good time and enjoyed every minute of it. I think every fellow felt when he went away, after seeing the kind of men that are in the association, that he was glad and proud to be one of them.

EXHIBITORS' ASSOCIATION DOINGS

On Monday evening the National Exhibitors' Association held a regular meeting and after receiving various reports appointed an auditing committee and nominating committee. These did their work through the week and the regular ticket was placed in the field on Wednesday and the members' ticket soon followed.

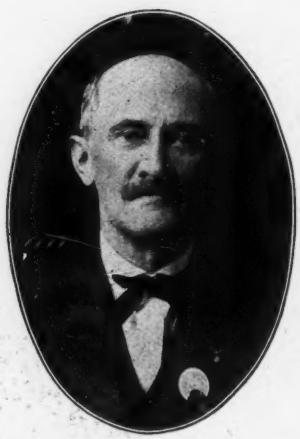
WM. G. LE COMPTE, JENKINS BROS., PRESIDENT N. E. A.

WM. D. PURCELL, QUAKER CITY RUBBER CO., VICE-PRESIDENT N. E. A.

HARRY ASHTON, ASHTON VALVE CO., SECRETARY N. E. A.

M. B. SKINNER, JAS. M'CREA & CO., TREASURER N. E. A.

The results of the balloting, which took place on Thursday evening, were the election of William G. LeCompte, of Jenkins Brothers, New York, as president; William D. Purcell, of Quaker City Rubber Co., Philadelphia, as vice president; Harry Ashton, Ashton Valve Co., Boston, secretary; M. B. Skinner, of James McCrea & Co., Chicago, treasurer; and as members



ROBERT E. HILLS, HILLS M'CANNA CO., EXECUTIVE COMMITTEE N. E. A.

of the executive committee Robert E. Hills, of the Hills-McCanna Co., Chicago, Geo. D. B. Van Tassel, of the Westinghouse Machine Co., Chicago, Frank Ransley, of Greene, Tweed & Co., Chicago, Hudson

Dickerman, of the Vanda Co., New York, and Homer Whelpley, of Strong, Carlisle & Hammond Co., Cleveland.

At a meeting on Thursday afternoon the retiring president, Herbert E. Stone, of the Dearborn Drug & Chemical Co., New York, was presented with a watch, chain and Masonic charm by the Exhibitors' Association as a token of appreciation of his good work, the presentation speech being made by Arthur L. Rice, of Practical Engineer.

Considerable dissatisfaction was expressed at this meeting by different exhibitors with the increase in rates made by the Southern Hotel in its charges to exhibitors and it was a satisfactory piece of news that the Rochester hotels had agreed to give to the officers of the N. A. S. E. within 90 days plans of all the hotels in Rochester, showing the room rates and guarantee that these rates and no others would be charged during convention week next year.

At the Thursday afternoon meeting it was also voted that a suitable recompense should be made to the retiring secretary, W. D. Purcell, for his work during the last 2 yrs., and the executive committee was instructed to look into the matter of appointing a permanent secretary and to report on this subject at the next year's meeting. That ended the formal business of the Exhibitors' Association.

Friday afternoon, when there wasn't much doing in the exhibit hall, there was a ball game at Recreation Park between the valve men and the packing men among the exhibitors, the teams being made up as follows: Packing manufacturers, J. C. Stout, Crandall Packing Co., captain; A. C. Kingston, Revere Rubber Co.; B. M. Bulkley, Greene, Tweed & Co.; C. D. Allen, Garlock Packing Co.; W. A. Koschnig, Mound Tool & Scraper Co.; J. M. Boreland, France Packing Co.; Chas. F. Seigrist, C. E. Squires Co.; F. G. Breiner, Anchor Packing Co., and F. A. Kohl, Anchor Packing Co.

The valve men's team consisted of Wm. G. Cummings, of the Chapman Valve Co., manager; A. O. Brown, of the Lunkenheimer Co., captain; G. L. Finch, of Jenkins Brothers; Frank Martin, of Jenkins Brothers; D. T. Williams, of the D. T. Williams Valve Co.; Charles Cullen, of the Wm. Powell Co.; H. J. Ernst, of the D. T. Williams Valve Co.; C. A. Davies, of Lunkenheimer Co.; Chas. H. Camp, of Strong, Carlisle & Hammond Co.; Harry Rhodes, of the Homestead Valve Co.

It was hard luck that Martin, who was the only real full fledged ball player in the crowd, and who had been playing ball all summer, should have a nasty accident and get his finger put out of commission in the course of the game. The final score was 11 to 10 in favor of the valve men. The rooters did their work valiantly during the game and hooted all decisions of the umpires, good and bad impartially, so that it was utterly impossible to judge whether the umpires were qualified or not. Their occupations didn't seem to indicate much of a knowledge of professional baseball; Jack Armour, of Power, was one, and J. W. Holman, of the Mining World, another, and E. H. Webster, of the American Steam Gauge & Valve Mfg. Co., filled in after Armour and Holman were worn out.

G. B. B. VAN TASSEL, WESTINGHOUSE MACHINE CO., EXECUTIVE COMMITTEE, N. E. A.

FRANK E. RANSLEY, GREENE TWEED & CO., EXECUTIVE COMMITTEE, N. E. A.

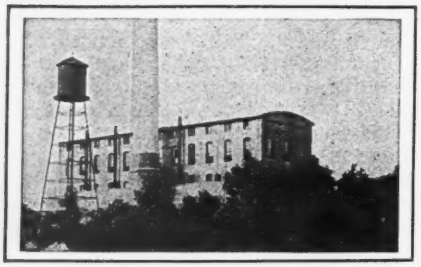
HUDSON DICKERMAN, VANDA CO., EXECUTIVE COMMITTEE, N. E. A.

HOMER WHELPLEY, STRONG CARLISLE & HAMMOND, EXECUTIVE COMMITTEE, N. E. A.

A NOVEL METHOD of extinguishing a fire on an ocean liner was adopted recently in the case of the Cunard steamer "Lucania," which took fire while in the docks at Liverpool and blazed so fiercely that it had to be sunk to extinguish the flames. The forward part of the boat was considerably injured so that decks and part of the hull plates will have to be replaced.

THE BALL TEAMS AND THEIR UMPIRES.

IN THE SANTE FE RAILROAD shops a method is in use for tightening belts easily. When first put on the belt is cut 6 in. short and a 6-in. piece laced into the gap. After a few hours this piece is returned to stock and a 5-in. piece put in its place; this is replaced by a 4-in. piece when needed and so on as the weather and stretch make desirable.



Power Apparatus

In Shop and Market

New Ideas in Making, Buying and Selling

SELLING GAS ENGINES THROUGH JOBBERS*

By M. F. Bates

I may say that my experience in selling gas engines to the jobbing trade has been most pleasing. I have experienced many little difficulties, I will say. For instance, if we have a gas engine concern and a large jobber buying gas engines, we sometimes have some little difficulty in bringing the true merits of our machine directly to the executive of the firm. But yet things are easily gotten along with if the proper channel is pursued. I feel that we as manufacturers should have our name on the engine. If, for some reason, the manufacturer and the jobber should not get along successfully we find that we have lost all the merits that our engines have earned in that section, and we have to start in as a new machine, as a new firm in the field, and the work that we have done and the merits of our engines are turned over to some other concern.

I feel that, as manufacturers, we should furnish for the jobbers as far as we can, men who are fairly well educated along the line of engine business; men who can install and who can go out and sell, if necessary, or take care of the troubles that may come up. This would wonderfully encourage the jobber and bring the whole proposition on an easy running basis. I think it would be better for us manufacturers, even if it costs us something.

As a whole, I must favor selling gas engines through the jobber. I think it is a fairly good way to do business. First, the jobber is on the ground. He has his trade. He has given his personal time to business, which is much better than the manufacturers can do, who might be a thousand or two miles away. He is on the ground personally, giving his personal attention to the business, and he certainly can take care of the work with much less expense than the manufacturer can do.

I feel the jobbers should be interested in our plants. They should say, "That is our plant. We are interested." On the other hand, we should be interested in the jobbing end. We should feel that it is our selling organization, and if we could afford anything to assist them, it should be our duty, rather than privilege, to do that, and so I feel that in a general way that selling engines through the jobbing trade is a very satisfactory way.

*Abstract of a paper read before the National Gas Engine Trades Association.

SETTING YOUR PACE

Before the National Association of Sales Managers, Hugh Chalmers gave in an address the following method which he has used for keeping himself up to high pressure:

"I was working on a commission basis. I had slips printed showing the days of the month from 1st to 31st, then figured my expenses for the month and made up my mind that I had to make expenses by the twelfth of the month, and every dollar to the twelfth of the month went for expenses. After the twelfth it kept me going to make money, and when I got down to the thirty-first day of the month I held on to that fellow like grim death, because I knew if I made the sale on or before the thirty-first I could write it on the 'profit' column, and, if I let it go to the next day, it had to go to the expenses of next month.

"That system will keep you 'going some,' because you want to close your business by months, not by years. The next day's sale did not cut any figure, only so much money thrown into the hopper for general expenses."

KNOWING THE GOODS

As illustrating the value of technical knowledge in selling machinery, E. S. Hanson gives this incident in Advertising and Selling:

Jackson, an engineering expert for a company selling a line of power machinery, went to a small city in the hope of landing an order for his company, and found that he must work under a big handicap. The engineer in his specifications had tabooed Jackson's particular type of machines; and the representatives of other concerns were there with prices which he could not possibly meet.

Jackson had one advantage; he knew every detail of the proposed construction, and had himself designed the arrangement on which his bid was based.

He pleaded his case from a professional and technical standpoint, purposely carrying it into details where the other salesmen could not follow him.

The result was that, in spite of his handicap, Jackson carried away the order.

The other salesmen were chagrined and mystified, and one of them remarked:

"Jackson, I don't see how you did that. Our engineer is a competent man, and I know his plans must be all right."

"Then why didn't your engineer come here and sell them himself?"

Recently a new achievement has been scored by one of the best known of the gasoline engines in the saving of the farmers in the flooded district of the Missouri valley, of something like $2,000,000 worth of wheat. The flood made the ground so wet that the bull wheel of the binder which drives the sickle slipped on the ground and would not drive the machinery.

The Gilson Mfg. Co. of Port Washington, Wis., experimented last year with the operation of the sickle and binding machinery by engine power and consequently were in a position to furnish through the Pioneer Implement Co. of Council Bluffs, Iowa, engines for driving the stalled reapers. When the demand came, the Gilson Mfg. Co. was kept running nights and holidays, even running July 4 and 5, and several carloads of its engines were sent forward to help out in the gathering of the crops.

PEOPLE AND THINGS IN THE MEMORIAL HALL EXHIBIT AT COLUMBUS, O., CONVENTION

NEW YORK BELTING AND PACKING CO. in its booth on the platform had an exhibit notable for the complete line of packings, including in the rod packings Cobbs, Vulcan, Amazon, Magic and Graphon, and in the sheets Indestructible, Ruby, Carbonite and Salamander, also a special packing called Firo for superheated steam. Sections of all these different styles were shown to illustrate the construction of the packings and what they would do. The souvenir book given by the company was written especially for them by Wm. H. Wakeman, who is well known to most of our readers, and was compiled to give information which would enable the operating engineer to say what should be put into a steam plant in the line of boiler, engine, pump, heater, etc., and to bring this knowledge to him without the use of complicated mathematics or difficult scientific terms. Representatives of the company in charge of the exhibit were: Chas. A. Wilhoft, of New York, manager; Frank S. Ruddell and B. T. Hadley, salesmen.

THE DEARBORN DRUG & CHEMICAL CO. was in the next booth, which had its usual full representation of live Dearborn representatives and extended hospitality to all comers. The biggest exhibit shown was Herbert E. Stone, president of the Exhibitors' Association and general eastern sales manager for the company, and to help him in receiving delegates and friends were W. A. Converse, secretary and chemical director, J. G. Beckerleg, of Chicago, P. H. Hogan, of Boston, J. H. Harkins, of Chicago, Dan Delaney, of Cincinnati, Jos. N. Gregory, of Buffalo, A. W. Crouch, of Pittsburg, D. H. Amsbary, Pittsburg, E. H. Ruhlman, of Cleveland, and Frank Eardley, of St. Louis. There were the usual laugh-producing stunts at the booth and also cute little bottles of perfume for the ladies, and spirit levels for the men.

QUAKER CITY RUBBER CO. had the next booth in line and boasted as its chief of staff Secretary Wm. D. Purcell, of the Exhibitors' Association. He was, however, too busy to spend much time at the booth and the courtesies were extended by H. A. Howe and A. D. Thompson, of the Philadelphia office. Special features of the exhibit were the samples of P. P. P. Packing, rolls of Ebonite sheet packing, Egyptian oval gaskets, valve disks, Valvolite twist, Skihi Red Sheet, and the Little Plumber's force cup which would evidently do the business but was of such shape that it might have been used for an egg-beater or to do your hair on or a dozen other household purposes. Those delegates who didn't go around to get the 6-in. steel scale in leather case which were presented by the Quaker City Rubber Co. missed something. A complete line of mechanical rubber goods, including cotton hose, rubber lined, and brewers' hose, which has a heavy layer of rubber on the outside of the fabric as well as on the inside to keep the water out, were also shown.

THE INTERNATIONAL CORRESPONDENCE SCHOOLS had a working exhibit showing the man that they can't wake up, and certainly he was not a sample of man that any of us would like to imitate. Prominent features of the booth were the portraits of T. J. Foster, envelopes from every part of the world, showing the widespread usefulness of the schools, letters from men in power plants in and about Columbus who had taken work in the schools and showing what they had accomplished, samples of the drawing instruments used in the courses, and of the reference library given with the text books. Representatives were J. D. Jones, general manager; C. B. Shaeffer, superintendent of the Columbus branch; C. W. Tannehill and J. E. Casey, of Columbus.

MARCO PACKINGS were shown in boxes and by samples, including Flax Core Cushion packing and Formed Wedge packing, which is the special strong point of the Marco wedge type. This has the wedge wound up from fabric instead of being cut from stock sheets, so that the edges do not fray. The Marco circle sign with winking lamps in the border was one of the striking and attractive booth decorations in the hall. The souvenirs given on Thursday were such as would delight the smoker's heart. The booth was in charge of W. E. Sanders, sales manager of the Mechanical Rubber Co., assisted by H. T. Fryant, of Jackson, Miss., W. A. Frise, of Flint, Mich., C. B. Iler, of Columbus, Ga.

H. W. JOHNS-MANVILLE CO.'s booth occupied two spaces in the exhibit floor and was in prominent position in front of the entrance doors. There was a surprise in store for visitors as the company showed a large line of fibrous packings in place of the asbestos line which is usual in the Johns-Manville exhibit. This line included molded and cut rings, coils and spiral packings, disks and sectional ring metallic packings, a full line of all styles and types. It showed also a metal armored coil packing which is new with the company. The asbestos roofing, siding, pipe covering and other specialties were represented by catalogs and circular literature. The booth was in charge of S. M. Hildreth, of New York, manager, and there were also H. McKinley, of Cleveland, E. E. Skinner, of Cleveland, and H. K. Thompson, of Columbus.

THE HOME RUBBER CO. had an inviting booth decorated with palms and a huge rubber plant and having as its center-piece of attraction a great roll of the N. B. O. sheet packing. A full line of mechanical rubber goods was shown, including hard rubber fountain pencils, which were given to the delegates. Dick Foley was in full sway at the booth when he wasn't out on the floor making friends, and when he was away R. B. Montgomery, of Pittsburg, was major domo.

EVERYBODY KNOWS ALBANY GREASE and everybody associates it with I. E. Tanberg and Adam Cook's Sons. If there was any doubt about the question before the convention, there isn't now. Tanberg was everywhere, especially at the booth, and anybody who doesn't know about Albany Grease and didn't get a sample of it to try out on his own machinery just didn't get anywhere near Tanberg, that's all. The booth decoration was pyramids of Albany Grease cans and a display of the grease cups which are furnished with the grease; and Tanberg proved that the cups were suitable for every place and that the grease is adapted to all kinds of machinery.

THE NEW CORLISS RELEASING GEAR shown in full sized model by the C. & G. Cooper Co. was of great interest and is certainly a novel piece of mechanism. It has the advantages of the knock-off cam always in contact and straight short motion of the knock-off block which avoids rounding its corners, and a short, sharp drop to close the steam valve. F. H. Thomas was in charge of the exhibit and showed besides this model of the cutoff mechanism a blue print sectional drawing of the new gas engine which has just been placed on the market after a careful proving out by the C. & G. Cooper Co.

THE RUSSELL FEED-WATER SOFTENER was a bit late in getting into line and so was placed in one of the rooms just off the main exhibit hall. Those who went in were well repaid by an interesting demonstration of the method of action of this system. The flow of the treating fluid is continuous, the amount supplied with the raw water being proportioned by a moving nozzle which in turn is controlled by a float in the supply system. The construction of the settling tank and softener tower was shown by a sectional wash drawing and explained by H. Russell, the inventor of the system, who was in charge of the exhibit for the Gem City Boiler Co.

THE HEINE SAFETY BOILER EXHIBIT showed a sectional view of the Heine boiler and setting which demonstrated clearly just how the boiler is constructed and how it operates to give rapid circulation. The exhibit was in charge of W. C. Morrison, of Pittsburg. J. E. Whittlesey was also present and explained the tests to which samples of the material used in construction of boilers have been put and which clearly showed the high grade of material used.

THE PHILIP CAREY CO. exhibit of pipe coverings, showed all kinds of molded and sectional covering, asbestos board and paper, and asbestos rope. Representatives of the company were H. W. Herrick and F. H. Kramig, from the factory at Lockland, Cincinnati, and D. C. Woodward, of Columbus.

HOLMES METALLIC PACKINGS, which were shown in the lobby at the west of the hall, attracted much interest because of their novel construction. Packings were shown for rods from 1 in. up to 16.5 in. diameter, and with water pocket for draining the condensation on vertical rods. These packings are made with sectional rings held in place by coiled springs and with joints broken between the different layers of rings, so that there is no possible leakage. Frank E. Emery, of Philadelphia, was in charge.

MCNAUGHTON SECTIONAL shaking, rocking and dumping grates are made up of sections of cast iron joined together by wrought bars, these sections being removable. The advantages of this system are evident and the construction, together with different styles of sections used for various fuels, were the attractions which drew delegates to the booth where C. P. Bassett was in charge. Mr. Bassett had a number of interesting slogans tacked up around the booth, a particularly catchy one being: "Let your coal bill pay for these grates."

J. WINCHESTER HOLMAN and P. J. COSGRAVE, of Chicago, were at the convention in the interests of the Mining World.

PHILADELPHIA LUBRICATOR & MFG. CO. had a novel system of applying grease to bearings by means of a compressed air grease cup which was demonstrated and the continuous action of the cup shown in a booth which was in charge of John F. Lewis, vice president, of the Philadelphia office, and Geo. W. Simpson.

CANCOS MANUFACTURING CO. showed its Black Squadron packings for steam and ammonia, and Cancos water packings for cold and hot water. The exhibit was complete in every line and showed also Cancos metal polish, which is good to use on either hot or cold metals. The booth was in charge of Harry Harmstad, of Philadelphia.

Allis-Chalmers Co.
MILWAUKEE, WIS.
Steam Turbines-Corliss Engines
32

Diamond Power Specialty Co.
DETROIT, MICH.
FLUE BLOWER

General Electric Co.
Pilley Packing & Flue Br
ST. LOUIS, M
133

Revere Rubber Co.
MARKED BY
REVERE
RUBBER
CO
BLACK BANK
REVERE RUBBER

Dearborn Drug & Chemical Works.
CHICAGO — NEW YORK.
Dearborn Drug & Chemical Works.
CHICAGO — NEW YORK.
154

Greene, Tweed & Co. Mfgrs.
NEW YORK.

G. M. Davis Regulator Co., as its name implies, is engaged in the manufacture of regulating apparatus, pressure regulating valves, pump regulators, back pressure valves, balanced valves, and as a special feature of the exhibit was shown a new design of the Davis steam trap. J. C. Kinsley and M. D. Neely, of Chicago, were in charge of this booth.

Cling-Surface has the merit of keeping new belts new and making old belts young, the only condition being that the old belts must not be so far out of condition as to have cracks and breaks in them. The Cling-Surface Co.'s exhibit, which was in charge of Dr. W. D. Young, secretary of the company, showed numerous cases of loose belts which had been treated by Cling-Surface and were running satisfactorily, and showed also samples of treated belts which had been running since 1901 still in perfect condition, and of untreated belts which were taken at the same time and were now stiff and dry. The difference between belts treated with Cling-Surface and those softened by the use of castor oil was also forcibly shown by the crackled specimens of the oil-treated belts in the booth.

Among the Heavy Machinery exhibits was that of the Dodge Manufacturing Co., which showed a full sized water softener head, four spaces being required for this purpose. The machine shown had a capacity of 1,500 gal. an hour and was the top of a softener exactly as installed, the settling tanks being, however, done away with. A pump driven by electric motor carried the water from the bottom to the wheel at the top, so that the motor, mixer and treating tanks were shown in continuous operation. At the sides of this exhibit were shown samples of the split iron and wood pulleys and open hangers made by the company, and a further exhibit of such apparatus was made in the booth of the W. H. Miller Co., Columbus, Ohio, where the exhibit consisted entirely of pulleys, shafting, clutches, and the Dodge bearing metals, in charge of C. O. Sherwood. The Dodge Company had in charge of its softener exhibit W. E. Galway, of Cincinnati, manager of the branch in that city; Geo. W. Matthews, of Mishawaka; Burke Richards, of Cleveland, and E. Eldon, of Mishawaka. Wm. H. Tupper, chief engineer of the Mishawaka plant, was also in attendance at the convention.

The Trill Indicator and the Triumph indicator with inside or outside spring and reducing wheel, were shown on a display board on which were mounted samples of these and also of the Triumph indicator for taking a continuous diagram. The exhibit was in charge of W. L. Trill and Leonard McElroy.

The Anchor Packing Co. made a special exhibit of its Tauril fibrous sheet packing, of semi-metallic and metallic Anchor packings, flexible and gasket packings and disks, and showed also a new type of expansion metallic packing. The souvenir given to delegates was a brass swinging ash tray and cigar holder, which was greatly valued by those who received it. The representatives of the company were Frank A. Kohl, of Detroit; Jas. L. Patten, of Cincinnati; Frank G. Breiner, of Detroit; J. F. Edmonds, of Pittsburg, and E. H. Morrison, of Philadelphia.

The New York & New Jersey Lubricant Co. showed pyramids of nonfluid oil in cans and of samples of cups used for feeding this lubricant to bearings. An attractive feature of the booth was the Spicer Universal joint for joining shafts which are slightly out of line or at a slight angle. J. D. Kelvie, of New York, was the manager of the exhibit, assisted by Clayton Tracy of Chicago.

Hills-McCanna Co., of Chicago, had a fine display of its force feed lubricators showing single feed in a round style of lubricator and 2 to 8-feed types in the square tank. The booth was finely decorated with palms, and Robert E. Hills was particularly pleased to show not only the lubricants but his new metallic disk. W. L. Boston, of Toledo, assisted at the booth.

Representing the Hawk-Eye Compound Co. were H. E. Tibbles, F. S. Dodge, R. S. Everitt, W. F. Ebert, J. P. Everett and I. E. Cook.

Fairbanks, Morse & Co.'s exhibit of duplex pumps was in the lobby on the east side of the exhibit hall. This was in charge of H. W. Vine, Cleveland, and J. F. Reeves, Cincinnati office, and consisted of a rack on which were mounted in pyramid form a duplex boiler feed pump, duplex high-pressure pump, duplex outside-packed plunger pump, and duplex power geared pump.

The Allis Chalmers Booth was one of the largest and most attractive in the hall. Three spaces were occupied and in these were shown an air compressor driven by electric motor, having a capacity of 20 cu. ft. of free air per minute; a display board showing the wheels and guide vanes of the Allis-Chalmers turbine; 2 5-hp. electric motors and parts of other machinery; also photographs of the gas engines and pumping engines built by the Allis-Chalmers Co. The booth was beautifully decorated with dwarf ferns and was presided over by A. H. Whiteside, manager of the steam and electrical department; R. D. Tomlinson, engineer in charge of Corliss engine and condenser division; J. H. Waterman, of the steam turbine department; F. C. Caldwell, of Cincinnati; W. B. Huskey, of Cleveland; C. J. Ratterman, of Cincinnati; R. C. Stueve, Cincinnati; C. P. Cook, Cleveland; Samuel Wolff, Cleveland; J. Weidman Murray, Pittsburg; J. W. Gardner, Chicago, and F. G. Bolles, of Milwaukee, commercial engineer who was in charge of the exhibit.

The Chapman Valve Mfg. Co. called special attention to its motor-driven valve which was a gate valve opened or closed by means of an electric motor, and by this means controlled from a switch at any distance. This valve was full size and is shown in actual operation connected to the motor and electric circuit. It was an 8-in. valve for medium pressure. Besides this was shown a line of angle and globe valves and the Morris blowoff valve which has a bonnet held by I bolts so that it is quickly removable for cleaning out the valve and has also a ring disk which can be renewed when worn. The exhibit was in charge of W. E. Cummings and Leroy Gordon, both of the Pittsburg office.

Strong, Carlisle & Hammond Co. showed an interesting and extensive exhibit of Strong steam specialties. The Strong vacuum trap was one of the novelties, made to remove condensation from vacuum systems and condensers; the Strong engine stop was another feature of the exhibit which drew and held the interest of engineers. This is a device which immediately stops an engine if it overspeeds, and cannot be reset without going to the stop and intentionally resetting the trip lever. A new style of hose clamp was shown with a wedge hold which will catch a hose at any point of its length and grip it tightly to hold it in position. Also in the booth were shown two different styles of automatic wheel-grip pipe wrench which are quickly adjusted to any size of pipe or round iron and the harder you pull the harder they grip. The Strong steam and oil separators, reducing valves and pump governors were also in evidence. Those in charge of the booth were Homer Whelpley, Cleveland; L. P. Strong, Cleveland; A. B. Penney, New York; F. H. Evans, Boston; Charles Camp, Philadelphia, and James Murdoch, of Pittsburg. A valuable remembrance in the shape of a pocketbook with accident policy for $1,000 contained was distributed from the Strong, Carlisle & Hammond exhibit.

The Parmelee Wrench Co., of Chicago, showed its wrench and ratchet drill which grips any size pipe by means of different heads to the same handle, and will catch a finished surface and cling to it without marring. A. L. Feiss was in charge of the company's interests.

Representing the Southern Engineer were W. R. C. Smith, J. W. Smith, H. H. Kelley, Robert Larkin, and Chas. W. Hill.

The Exhibit of the Wright Mfg. Co. showed by means of apparatus and photographs the special steam products of the company, including a section of the Wright safety alarm water column, and model of the Wright Emergency high-pressure and Victor low-pressure steam traps, Cyclone exhaust head, a line of ball floats of different sizes, such as are used in the traps and columns, and a solid brass water column for marine practice.

In the Austin Separator Co.'s exhibit different styles of steam and oil separators and wash drawings of the full line of apparatus made by the company, showing the different methods of separating water and oil from steam, were displayed, demonstrating clearly the principle of action and method of construction. W. M. Chamberlin and Chas. W. Locker, of Detroit, were present as representatives.

C. H. Crockett, Trouble Man for the Detroit Lubricator Co., arranged a frame of brass specialties including cups, oil pumps, cylinder lubricators and quick-acting balanced throttle valves for hoisting engines and a novelty in lubricators, the 4-feed Bull's Eye hydrostatic type for locomotive use.

In the Booth of A. C. Judd, of Cleveland, O., were found a number of specialties for which Mr. Judd acts as representative in that territory; sheet packing and gaskets made by Feodor Burgmann, of New York; metallic packing as made by the American Huhn Metallic Packing Co., New York; blowers and forced draft systems as made by J. T. Wing Co., New York.; all were given prominent positions. The sheet packing shown is a fiber asbestos and rubber combination, which will not burn or crack and oil can do it no harm. The metallic packing is of the split ring form, held with coil springs. The Wing turbine blower was shown in operation and also the Wing ventilating fan and method of controlling the blower for forced draft systems by means of a pressure valve. Those in charge of the exhibit were F. M. Burns, representing the packing interests; J. C. Burke, in charge of the blower interests; A. C. Judd, manager, and E. J. Weller, representing the L. J. Wing Mfg. Co., of New York.

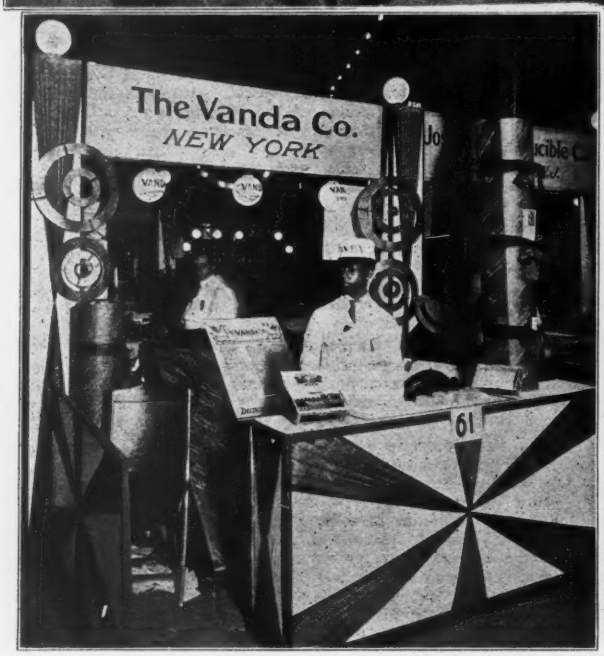
The American Radiator Co. Norwall Department showed valves for the control of air in heating systems, both pressure and vacuum, and also in the Bundy department showed a line of traps and separators, the sectioned model traps being of the separating type and also of the tilting return type. Representatives in

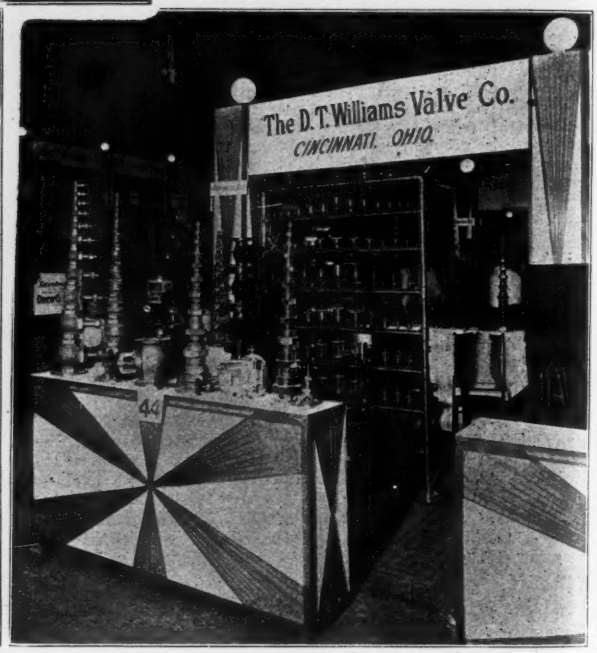
the Norwall department were John W. Rowe, of Boston; E. H. White, Chicago; and in the Bundy department E. M. Stevens, Boston, and A. S. Mappett, of Philadelphia. The Sylphon device for the control of heating systems was also on exhibition and was one of the special novelties to be found in the hall.

France Packing Co. was represented by A. W. France, president, and J. F. Boreland, sales manager. The exhibit consisted of a large display of metallic split ring and spiral packings, coil flax packing of the self-lubricating type and square and spiral

dent of the company, after years of experience in the business, and Mr. Squires, together with C. Seigrist, mechanical engineer, and G. W. McEwen, sales manager, entertained visitors at the booth.

A. W. Chesterton Co. showed its usual line of packings and engineer's tools, including the combination scraper and brush, Chesterton square flax, Metalbestos, Rubberbestos, coil, tubular, metal-covered and combination steam and hydraulic lines. H. D. Raymond was the company's representative.





packings. The company called attention especially to its successful metallic packing for ammonia compressors and for gas engines, to the automatic expansion fibrous packing for steam hammers and to its tubular asbestos gasket.

The Fairbanks Co. showed Dart unions, Geipel's steam trap, valves and valve disks, blowoff valve and ammonia fittings. L. B. Mann, of New York; B. Richards and W. McClausen, of Pittsburg, were at the exhibit.

The Squires Improved Steam Trap and other specialties were prominent in the exhibit of C. E. Squires Co., of Cleveland. These specialties were all designed by C. E. Squires, presi-

V. D. Anderson Co. showed a line of its traps including Nos. 2, 3 and 5, with reinforced float. The convenient little pocket book of information distributed from the booth was appreciated by those who received it. The constructional features of the Anderson trap were shown by means of models and sectioned full size traps. These are made in seven sizes, from one-half to two and one-half inch. Another novelty at the booth was the Anderson engine room oil filter which is made in four sizes, from 2 to 40 gal. capacity, and has as a filtering medium easily renewable disks of paper, built up in sections according to capacity, which take out impurities as the oil passes

through. Those who visited the booth found the familiar faces of J. H. Meyer, of Detroit; H. J. Meyer, of Cincinnati, and I. P. Lounsberry, of Chicago.

THE MANISTEE IRON WORKS has a surprise in the form of a valveless duplex steam pump. This is exactly what the name implies, a pump having no valves in the steam cylinders, the admission and exhaust of steam being controlled by the action of the steam pistons themselves. The water ends of these pumps are much the same as for an ordinary pump. W. G. Sims represented the company at the convention and told of remarkable performances of this pump, and to clinch his claims sold the pump that he had on exhibition.

FOR THE MICHIGAN LUBRICATOR CO. F. N. Stocking and Robert Davidson, superintendent of shops, were at the convention and had arranged an attractive booth in which were shown the line of lubricators and cups made by the company, special attention being called to the lubricator having a special ball stop valve to hold oil from flowing out when draining the water from the lubricator, and the Bull's Eye 4-feed locomotive lubricator. This was arranged with an auxiliary sight feed for permitting the use of an extra large amount of oil in emergency or for use in case of stoppage of the regular feeds. The arrangement of the exhibit on a cross-shaped frame made it particularly attractive and get-at-able.

W. B. MCVICKER CO., chemical engineers of New York, had the champion Bill exhibit. In the first place, there was the Bill dog, which kept watch over the booth and winked his other eye impartially at all comers; and there was Bill Schatz, who never was at the booth except by accident, but he was making himself strong with engineers everywhere else; and there was Mr. McVicker himself, the boss Bill of them all, who explained to those interested that "We analyze things" and "provide a remedy for all boiler troubles."

IN THE BOOTH OF THE Crane Co. were shown the tilting return trap which is used for both non-return and direct-return. The decorations on this booth were a beautiful display of palms arranged by the representative, C. O. Lindahl, of Chicago.

JOHN A. ROEBLING'S SONS CO. displayed a section of heavy cable and a board showing wire rope of all sizes. A special product of this company is armature field coils ready wound for different styles of machines. E. T. Georger, of Cleveland, and J. W. Troescher, of New York, were the representatives.

DIAMOND RUBBER CO.'s Indian Red packing was the prominent feature of its booth. Rubber in all stages of manufacture, beginning with packs as brought down to the coast of Africa from the Interior, and the sheets as partially purified and sent out from the East Indian Islands, up through the completed product were displayed. An interesting feature was a cover made for storage battery jars having the top vulcanized hard and the lip which fits over the edge vulcanized soft to make a tight joint. Hose for suction and pressure was shown in many different sizes and types. Representatives at the convention were: I. R. Bailey, sales manager of mechanical goods; David Pearson, Jr., and W. E. Hardy.

DIAMOND POWER SPECIALTY CO. showed a full size Diamond Flue Blower mounted in a model of a boiler setting. This was arranged to show exactly the operation of the device and how quickly and thoroughly it would take the soot and ash out of the tubes of a boiler. John Harley, of Cincinnati, was in charge of the exhibit and showed at the booth as well as the flue blower an expansion pump piston packing of his own invention which has novel features. It is expanded by two screws in the head of the piston which can be tightened or loosened without removing the cylinder head and which can be operated independently of each other, so that one-half of the packing may be tightened without tightening the other half, thus keeping the packing down so that the piston head is kept off the cylinder. Also by means of this expansion device the pump packing can be worn down until it becomes very thin, thus saving the trouble of frequent repacking and the cost of renewing.

THE VANDA PACKING CO., of New York, showed its Black Vanda packing in a particularly attractive booth, arranged by Hudson Dickerman, salesmanager. Mr. Dickerman had leather card cases for delegates who visited the exhibit and for the ladies in attendance handsome coin purses were given out by Mrs. Weaver, president of the Ladies' Auxiliary, who took charge of this matter for Mr. Dickerman. The Vanda packings were shown in sheet and gasket form and the booth was lighted by globe lights with the Vanda name emblazoned on them. The company has now established agencies in all important centers where the packing can be obtained and the service in filling orders will be as prompt and courteous as was the service of the Black Vanda kid in the exhibit booth.

JOSEPH DIXON CRUCIBLE CO. decorated its exhibit space with ferns, using as jardinieres Dixon graphite crucibles. The flake graphite was shown in cans as prepared for various purposes, Graphite Grease and its uses were illustrated, also Graphite Pipe Joint Compound ready prepared for use. Carbon motor brushes, as manufactured by the company, were shown in a large variety of shapes and sizes. F. R. Brandon, of Chicago, and L. W. Brooks, of Jersey City, were the representatives and supplied delegates with various kinds of pencils.

A PARLOR OF PALMS where delegates might rest and talk over things was the contribution of Jenkins Brothers to the exhibit hall. Of course they had a line of Jenkins Brothers valves in globes, angles and Y's, valve disks and tubular gaskets, and they showed also rolls of the '96 sheet packing, but the best contribution that Jenkins Brothers made to the convention was Bill. Of course, everybody knows Bill, always has known him and everybody was glad to see him elected to run the Exhibitors' Association next year. His last name is G. LeCompte. Frank Martin was also on hand and did his usual full share towards making everything go off smoothly, assisted by H. C. McLaughlin.

THE DISTINCTLY DIFFERENT EXHIBIT of the Hoppes Mfg. Co. was designed to show what the Hoppes Open Feed-Water heater and Purifier actually does in practice. A section of scaled pans taken from the power plant of one of the state institutions located in Columbus, was mounted upon its framework as in actual service, and clearly showed how efficient the trough-shaped pan used in multiple is in removing impurities and scale-forming material from the feed water. There were also shown at the exhibit Hoppes steam separators, oil eliminators and exhaust heads. J. F. Ware and Chas. E. Hoppes had charge of the company's interests.

THE D. T. WILLIAMS VALVE CO. arranged a complete and attractive exhibit of its lines of unions, plug cocks, check valves of both straight and angle type, cast-iron globe valves, brass globe valves, quick closing valves, all assembled in the form of totem poles which distinguished the booth from all others. The entire display was taken from the commercial stock of the company and was in no way different from the product as delivered on order to customers. Besides these valves the Cookson traps were shown, also the Cookson steam separators and a frame mounted with oil and grease cups and other brass specialties. The exhibit was arranged by H. J. Ernst, who is in charge of the advertising for the company. Other representatives were D. T. Williams, president, and C. K. Thomas, manager.

ZENA AND SELDEN PACKINGS formed the exhibit of Randolph Brandt, of New York, who told many good stories of the success which these packings have had in difficult service. The Zena packing is particularly adapted for outside packed plunger pumps and has been used in the Comstock mines and other deep drillings where the water is at temperatures as high as 145 deg. F. when handled by the pumps.

THE MONARCH VALVE & MFG. CO., of Warren, Mass., called special attention to the loose neck nut which enables the plug to be removed from the valve seat without any exertion. The nut can be detached from the handle, which allows the engineer to repack his valve without burning his fingers. Another novelty in this exhibit was a regrinding gate valve which has a cam at the bottom. The gate proper is a plug which rises ⅜-in. and then turns ¼ way round, giving a straight hole through the body of the plug with opening the full size of the pipe. The bottom cam permits this plug to rise free from the body before it turns, and when closing it first turns to shut off the water and then is carried downward to the seat. This valve has been in operation under pressure of 250 lb. for 2 yr. without attention. When there is any abrasion or cutting a little application of emery and oil will permit of regrinding to a tight fit. W. D. Hosley, traveling representative, was at the booth.

JAMES MCCREA & CO. brought out the new Skinner Valve Reseating Machine which interested all who saw it. This is an effective piece of apparatus although of small size and of moderate cost. This, with the Perfect valve disk, Climax steam joint and Emergency pipe clamps, Emergency pipe saddles, H. H. steam traps, Century gasket cutters and drilling machines, and Butman flue rods, made up a varied and interesting display. M. B. Skinner, treasurer of the Exhibitors' Association and president of the company, was in charge of the booth, with F. B. Upson, New England representative, assisting him.

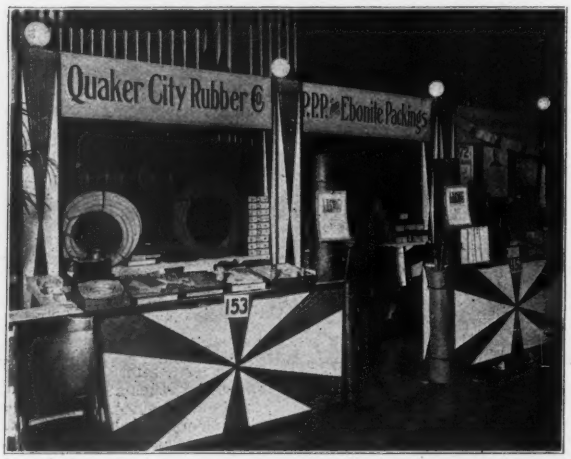
MOUND TOOL & SCRAPER CO., toolsmiths, showed different sets of its engineers' tools in wooden chests and leather cases, including packing tools, spring steel screw packing pullers, scraping tools and flue scrapers. A. G. Langenohl and W. A. Koschnig, of St. Louis, represented the company.

LAGONDA MFG. CO., of Springfield, Ohio, kept its exhibit on the go and its representatives kept on the go all through the week. It was fascinating to an engineer to watch the action of the Liberty cleaner with the new style feed for Stirling boiler tubes and to think of the great saving in time and temper that would be accomplished by the use of this equipment. Of course, there were the Weinland power cleaners for drive by air, steam

or electric motor, and with all kinds of heads for all sorts of conditions of boiler scale. In charge of the booth were M. M. Sellers, sales manager, E. E. Hower, superintendent, Jas. H. Johnston and C. F. Oberly, of the Pittsburg office, and J. P. Malloy, of Chicago, and W. J. Patterson, of Boston. H. S. Bradley, vice president of the company, and H. F. Weinland, inventor of the Weinland cleaner, were at the convention during the latter part of the week. A new device of the company is the Quick Repair head which requires only a monkey wrench to put on new cutters when the old ones become worn.

THE UNDER-FEED STOKER CO. OF AMERICA was not, of course, able to show its stokers in operation at the exhibit hall, as too much space would be required and the weight would be more than the floor would carry, but they did show a complete line of descriptive matter and instructive and attractive pocket catalog and a little folder called "Our Poster Girl, an Interesting Experiment," which, on opening up, proved full of interesting possibilities as well as information. Representatives in charge of the booth were W. R. Faben, of Toledo, and Wm. T. Johnson, of Buffalo.

PEERLESS RUBBER CO. in all that it does lives up to the promise of its name. The Columbus exhibit was no exception



and the full line of mechanical specialties, including the old and well known Peerless and Rainbow packings, Dale's steam trap packing, Honest John sheet packing, lines of floor matting and rubber tiling, hose for water, steam and air, made up an interesting as well as striking display. The souvenir given out by the advertising manager, Stephen Roberts, consisted of a fine Wostenholm pocket knife in leather case. Besides Mr. Roberts, the Peerless representatives were Herbert Self, of New York, and Dan Cubberly, who runs the Denver store for Geo. B. Carpenter & Co., western representatives of the Peerless Rubber Co.

THE ERIE STOKER was the exhibit of the Erie Foundry Co. A full size stoker just as it would be installed in a boiler made a most impressive display and the printed matter describing this and the Erie traveling grate explained in full the details of construction and the advantages of this method of firing a boiler over the ordinary hand-firing routine. J. S. Van Cleave, president and general manager of the Erie Foundry Co., and J. A. Leiter entertained friends at the booth.

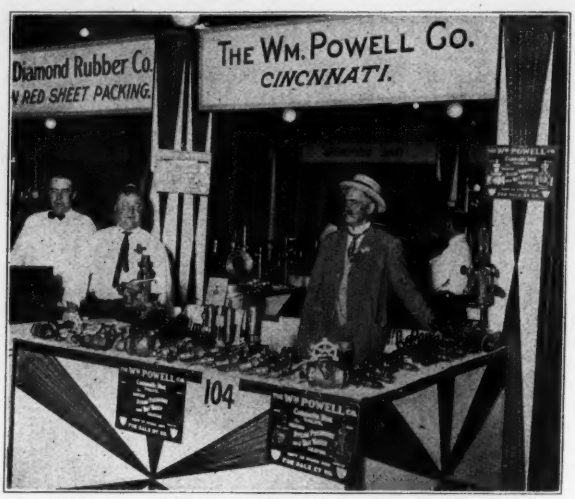
FOR THE HILL PUBLISHING CO the representatives present were Fred R. Low, O. Monnett, F. R. Johnson, C. W. Dibble, Jack Armour, C. E. Beard and A. J. Bamford.

GREENE, TWEED & CO. displayed its usual line of Palmetto packings in all classes and showed also the Favorite ratchet wrench and Palmetto twist. A new type of packing introduced by the company is the Manhattan self- lubricating for low pressures, either steam or water. The Palmetto cigars were in evidence but the Green Bugs of former conventions did not swarm. F. E. Ransley, of Chicago, and B. M. Bulkley did the honors of the booth, which was equipped with easy chairs, oriental rugs and a writing desk for the convenience of delegates.

IN THE GRISCOM-SPENCER BOOTH adjoining was shown a full size feed-water heater of the Reilly Multi-coil type, in charge of R. J. Pabodie, of New York. This exhibit was shown in connection with the Coe shaking grate made by the Geo. H. Thacher Co., the Griscom-Spencer Co. being New York agents for the Coe grate and the Thacher Co. acting as agents in the Albany territory for the Reilly heater. Geo. H. Thacher, Jr., represented his concern at the booth. The heater works on the principle of rapid circulation of water through spiral coils of piping which brings all parts of the water in contact with the heating surface and thus gives rapid heating. The Coe grate is made up of loose pieces attached to bars and is arranged so that there is air circulation all around the web of the bar and no bolts are used in putting the grate together. This gives a grate that is always cool and the sections are made up in different patterns so as to give from 8 to 40 per cent of air area, according to the needs of the fuel. The grate is made to shake and dump at will.

THE WILLIAM POWELL CO. is known in all engineering circles as the manufacturer of the White Star valve. Besides these valves, which are double disked, and the Union Disk valve, which has a composition disk, the display of the Powell exhibit included all sizes and types of globe valves for steam and hydraulic use. Chas. E. McFarland, vice-president of the company, and Chas. Cullen, of Cincinnati, were demonstrating the merits of the valves, whistles and other brass goods shown. The valves have renewable disks and beveled seats which allow of the steam cleaning the seats as the valve closes, and the disk has a guide on the bottom to insure its closing true. "High Grade" is the motto of this company and accounts for its continued success through so many years.

KEYSTONE LUBRICATING CO. arranged its exhibit with the idea of showing the actual method of using Keystone Grease for all sorts of lubrication. A miniature Corliss engine driven by electric power was equipped on all bearings with grease cups of different styles, showing just how the applications should be made to get the best results. Samples of the different grades of Keystone Grease and literature explaining the purposes for which they are suitable were displayed in the booth. Chas. A. Hopper, of Philadelphia, was in charge of the booth, and assisting him were T. W. Armstrong, of Chicago, western manager, L. L. Lacey, of Columbus, C. M. Gilbert, in charge of the Indiana territory, L. A. Christian, of Huntington, W. Va., man-



ager of the Virginia territory, and M. B. Urquhardt, of Denver. Delegates were provided with the Keystone caps for engine room wear and with souvenir clothes brushes.

THE CLEVELAND FEED WATER REGULATOR CO.'S booth was looked after by R. J. Bissett and J. B. Youngblood, who control the sales of this regulator. The action of the device was shown by a full sized working model with pump connected to move the pilot valve, which lets steam in to open the valve on the feed-water line and also operates the pump regulator in the steam supply line.

THE PENBERTHY INJECTOR CO. was represented at the convention by G. S. Hammond, advertising manager for the Penberthy Engineer and Fireman.

THE DESMOND-STEPHAN CO. had a new thing in injectors called the Model U and which "fits any old connection." It is made with a joint in the middle of the body so that the supply from steam and water and the delivery connection can be placed at any angle, thus doing away with special styles or elbows and bends in connecting the injector. Besides this model there were shown sections of the Desmond injectors of the regular type and full sized working instruments, the Sherman emery wheel dresser and the Stephan belt dressing. H. H. Dovell, of Urbana, Ohio, was in charge of the exhibit.

MCLEOD & HENRY CO., with its Steel Mixture for arches and boiler settings and with its model of a complete setting made from the Steel Mixture, had always an interested audience, particularly as the representatives, John H. Foote and John H.

Foote, Jr., of New York, were presenting to each delegate a handsome bill book and card case and were sppplying the youngsters of the convention with clickers to drive dull care away and everybody around them distracted. The "old-fashioned cigar lighters," which when scratched had a decidedly sulphurous smell, caught a lot of the boys and everybody was trying to push the joke along onto the next fellow.

THE ASHTON VALVE CO., represented by the old stand-by, Columbus Dill, who keeps his vigor in spite of his long term of service, and Harry Ashton, who was elected secretary of the Exhibitors' Association, showed a number of attractive departures from past practice in steam gages and specialties. The new style of pop valve was interesting, also the Ideal alarm gage, the chime whistle and the boiler inspector's test pump. A marble gage board fully mounted was an attractive feature of the booth.

THE WESTINGHOUSE COMPANIES had a combined exhibit in which the product of the Westinghouse Air Brake Co. held the chief place. This was a portable air compressor, motor driven, which had a capacity of 15 cubic feet of free air per minute, and a compressor steam driven, having a capacity of 45 cu. ft. per min. These were both of the portable type, suitable for

REPRESENTATIVES OF KEYSTONE LUBRICATING CO.

blowing out electrical machinery in power houses, auto garages and similar locations. The motors for these compressors are wound for either alternating or direct current of any commercial voltage. The representatives at the convention were S. H. Mills, of Pittsburg, T. W. Newburn, of Columbus, R. W. Williams, Cincinnati, F. H. Park, Pittsburg, and M. H. Burchardt and G. D. B. Van Tassel, of Chicago.

L. G. FINLAY & CO., represented by L. G. Finlay, exhibited a 15-hp. Terry steam turbine, a 3-in. Blackburn-Smith feed-water filter and grease extractor, and a Turbo-blower. This company is also the Ohio agent for the Sight Feed Oil Pump Co., whose exhibit adjoined, and has offices in both Cleveland and Columbus. It is also agent for Jeannesville Iron Works Co. and the Trenton Engine Co.

W. E. RICHARDSON, president of the Sight Feed Oil Pump Co., of Milwaukee, which manufactures the Richardson force feed lubricators, and L. G. Finlay, Ohio agent for the company, had an exhibit consisting of a large gas engine oil pump similar to those used on all large gas engines, a number of smaller force feed lubricators and a line of the Union-Cinch pipe fittings, Model C and Model A, for connecting up oil pump systems.

THE REVERE RUBBER CO. used rubber plants for the decoration of its booth, a most appropriate background for the display of Black Hawk packings and the other special brands, Usudurian, Samson, Revere and Shawmut. The engineer's information chart compiled for the state of Pennsylvania, but good for engineers in any state, attracted much attention as a convenient engine room reference sheet. A. W. Dudgeon, of Boston, superintendent of the packing department, L. H. Irwin, of Pittsburg, and A. C. Kingston, of Chicago, were at the booth.

A. W. CADMAN MFG. CO., of Pittsburg, were on hand with a full line of Cadman specialties. These included the Cadman Indestructible blowoff valves with brass-bound solid copper reversible disk, the Indestructible gage cock valve and seat which has reversible disk and positive shutoff, the Cadman split plug valve and Cadman Aluminum babbitt metal. The representatives of the company were A. W. Cadman, A. M. Cadman and R. W. Cadman.

THE BROWNELL CO., because of lateness in making arrangements for its exhibit, was unable to make the showing which it otherwise might have. Its booth in the west lobby was, however, well surrounded with visitors and the catalog literature and photographs showing the construction of the Brownell engines were effective explained by H. V. Neff, of Zanesville, Ohio, who was in charge of the booth. He presented to delegates who visited him a convenient pocket magnifying glass and tweezers.

HOMESTEAD VALVE MFG. CO., of Pittsburg, sent as its representative P. L. Rhodes from the home office. The exhibit included the Straightway blowoff valve, 3 and 4-way steam, air and hydraulic valves, and a standard line of regular globe and gate valves. The Straightway blowoff has the feature that the water passes straight through the valve and the construction is such that the valve is released from the seat when turning, thus avoiding cutting of either plug or body surfaces. It has been christened "the World's Best Blowoff."

THE OHIO GREASE LUBRICANT CO. has devised an apparatus for the feeding of grease as a cylinder lubricant, a thing which many have tried unsuccessfully to accomplish. This is done by means of a superheating chamber in which the grease is heated to the consistency of oil. The grease melts at 112 degrees and by the use of this device a saving of 25 per cent is guaranteed in the cost of cylinder lubrication. The company reports a most favorable reception of its apparatus by the members of the association and an increase of nearly 100 per cent in its business in 60 days. The corps of representatives included F. W. Rogers, a charter member of Michigan No. 2 and one of the oldest members in the state of Michigan, W. S. Hissom, Rob Orin and Elmer E. Miller, formerly state examiner for Ohio.

THE NORTHERN EQUIPMENT CO. had on exhibition a model of the Coates boiler feed water regulator and pump governor, which was full sized apparatus and showed exactly the working of the device. The representatives were J. D. Pounds, assistant sales manager, L. J. Murray, of Cleveland, and L. S. Taylor, of the Hamilton Mfg. Co., of Columbus.

MANNING, MAXWELL & MOORE displayed in its booth the products of the Ashcroft Mfg. Co., the Consolidated Safety Valve Co., the Hancock Inspirator Co. and the Hayden & Derby Mfg. Co. The special features of the booth were the Improved Consolidated pop safety valve, Improved Tabor engine indicator, the Ashcroft prismatic water gage, the Binary blowoff valve and sectioned models of safety valves with both inside and outside spring. The Hancock valves with zero wheels were shown, Tabor reducing motions, the Tabor planimeter with both wood and metal back, Ashcroft recording gages, and the Ashcroft gage tester. C. Monroe Smith, of New York, and L. M. Brigham, sales manager, were in attendance.

THE GENERAL ELECTRIC CO. displayed a novel form of Magnetite arc lamp having as the upper electrode copper and magnetite ore and as the lower electrode a tube filled with magnetite. This feeds from the bottom and gives a long burning lamp which requires trimming once in 150 hr. and saves 25 per cent of the current. The entire exhibit of the General Electric Co. was in operation, including a 35-kw. horizontal Curtis turbo-generator unit which was driven from the generator end and controlled by a switchboard which was fully equipped with instruments. Detail parts of the turbine nozzles and blades were shown and at the sides of the booth were mounted a 16-in. bracket fan and a 12-in. fan with universal joint on the wall bracket, which was arranged to swing so as to cover an arc of 108 degrees. The exhibit was in charge of F. B. Gantt, of Cincinnati, and there were also present W. S. Culver, of Cincinnati, and Dr. L. C. Loewenstein, of the steam turbine department, Lynn, Mass.

THE PILLEY PACKING & FLUE BRUSH CO. was represented by M. E. Briggs, of Chicago, and Grant I. Rawson, of St. Louis. They showed a flexible metallic protected fibrous packing having the inner rings of any suitable soft material and the end rings of braided copper wire. They showed also the Noburn gage glass valves arranged so that they can be closed from the floor on the breaking of steam gage and permit the insertion of a new gage without danger to the engineer. Both valves are closed by one chain and are of heavy construction. The booth also contained a full line of packings, scrapers, brushes, cleaners and tools for the engineer's repair kit, and a special line of combination packings for hot and cold water and for high and low-pressure steam. A new style of packing cutting machine was shown which appealed to engineers as having great possibilities for saving engine room trouble.

H. B. UNDERWOOD & CO., with its line of engineers' repair tools, is always sure of an interested audience. Arranged as for actual operation were shown a crankpin turning and a crank disk boring device, and a cylinder boring machine. Smaller specialties exhibited were an improved dashpot for Corliss engines, the St. Johns steam packing for engine pistons and an improved suction valve for ammonia compressors which is noiseless and will not drop into the compressor cylinder if the valve

should break. E. C. Crawford and Edwin J. Rooksby were in charge of operating the machine for the information of visitors to the booth.

THE LIBERTY MFG. CO. emphasized particularly the merits of its Norivet cleaner head and showed also a frame carrying camples of its cleaner motors for air and steam in various types. A sectioned model was shown of the Liberty feed-water regulator, and several sizes of the Liberty Greenaway separator, the Liberty pump regulator and the Liberty twin strainer. The representatives at the convention were Geo. R. Noble, eastern sales manager, D. S. Tucker, manager of the Cleveland office, and Harry A. Pastre, special representative; during part of the convention W. S. Elliott, president of the company, was present.

GEO. S. BAKER, of Cleveland, Ernest Blackshaw, of Cincinnati, and F. Walker Maury, of Chicago, who is the manufacturer's agent for the Bayer Soot Blower Co., of St. Louis and Chicago, were in charge of a novel exhibit which showed a device for cleaning the tubes of water-tube boilers of ash and soot.

AT THE BOOTH OF THE Geo. W. Lord Company were found Geo. W. Lord, president of the company, Edward McCarthy, manager of the Pittsburg office, who was in charge of the exhibit, C. M. Brown, of Indianapolis, state manager for Indiana, Wm. Hulvershorn, of Cincinnati, and B. L. Lord, of Philadelphia. Souvenir coin purses, compound barrels, and views of Philadelphia were distributed. The booth was decorated with palms and with illuminated signs of welcome showing that the company's representatives were "Glad to meet your smiling faces" and proclaiming that "Our market is the world."

CRANDALL PACKING CO. made a special feature in its exhibit of the 'lip" packing No. 116 for elevators and pumps. This is a self-adjusting packing which binds more tightly the greater the pressure applied to the pump cylinder or elevator plunger. Other styles shown were the Regina and the Helios. J. M. Chapman, manager of the Cleveland office, assisted by A. M. Beadle and J. C. Stout, presented visitors with useful and attractive souvenirs.

WESTERN KEILEY SPECIALTY CO. showed a full line of the Keiley & Mueller steam specialties including feed-water regulator, reducing valves, bucket trap, pump pressure regulator and water column. John Boylston and E. N. Murphy were in charge of the exhibit.

ALTHOUGH HAVING ARRANGED FOR SPACE, the Buckeye Engine Co. was unable to get an exhibit to the convention and its booth was, therefore, left vacant, much to the regret of those who had hoped to see Mr. Weeks as usual.

E. M. SWINDLER, of St. Louis, represented the Arrow Boiler Compound Co.

TRIUMPH ICE MACHINE CO., of Cincinnati, represented by H. D. Pownall, made a complete display of its ammonia fittings of cast steel, the Triumph automatic gage cocks and a partial display of parts of the Triumph ammonia compressor.

KENT LUBRICATING CO., of Waukesha, Wis., represented by L. H. West, treasurer, showed a line of grease cups and oilers for the lubrication of bearings.

A. D. FERGUSON AND J. M. WALTON represented the Gage Publishing Co. in the interests of Steam.

THE AMERICAN STEEL & WIRE CO. had a pyramid of reels of wire cable which formed a striking feature in the booth and was flanked on either side by boards showing samples of wire rope of all sizes. A. T. Merriman and George Chandler arranged the exhibit and were in charge of it.

THE MASON REGULATOR CO. sent to renew old friendships its ever welcome representative, Frank L. Morrison, and sent as an exhibit Mason pump regulators, pressure valves, float valves and sections for showing the operation of the different devices.

JOS. T. RYERSON & SON had a working exhibit consisting of a model of the Continental boiler which is a modification of the Scotch marine type and requires no brick setting. It has an internal corrugated furnace and the model was arranged with glass sides so that the generation of steam in the boiler could be seen. This arrangement of boiler gives large capacity in small space and it will burn low grade fuels economically. A display of Glyco bearing metal was also made and skeleton construction bearings for all classes of machinery. The exhibit was in charge of J. T. Corbett and L. E. Skinner.

ERNER & HOPKINS CO., of Columbus, showed a line of electrical specialties and apparatus in charge of M. A. Pixley.

ALBANY STEAM TRAPS in non-return and direct return styles were shown in section with a large part of one side removed so that the whole operation could be seen. Some special valves were also shown by the company, which is now in its 40th year in the manufacture of traps and steam specialties. Thos. F. Ryan, of Albany, secretary and treasurer of the company, was its representative.

THE RIDGWAY DYNAMO & ENGINE CO. sent its greetings and a statement that its business, owing to the appreciation of engineers throughout the country of the merits of its apparatus, has shown great activity during the first 2 quarters, July for this year showing the largest business of any July in the company's history.

HARRY KNOWLTON, of Detroit, represented the Hartford Steam Boiler Inspection & Insurance Co., although no exhibit was made as the company has, of course, no apparatus to display.

THE LIMBERT SUCCESSFUL FLUE BLOWER was exhibited by S. H. Limbert, of Springfield, Ohio. This is a steam blower to be installed in the rear end of the boiler setting for blowing dust and ash out of the tubes and the operation of the device was fully shown in the exhibit.

AMERICAN STEAM GAUGE & VALVE MFG. CO., represented by E. H. Webster, of Chicago, made a fine display of recording and indicating gages and a clock on a marble gageboard, which was mounted on a brass easel in the booth; it made a most attractive feature. Besides these were shown the American pop safety valve, the American gage tester, which tests a gage against standard weights, the American Thompson Improved indicator with inside and outside spring, and Thompson Improved reducing motion, and examples of whistles and other brass specialties.

PRACTICAL ENGINEER representatives at the convention were E. R. Shaw, president, Arthur L. Rice, managing editor, Chas. S. Clarke and C. B. Leech.

THE HAMLER-EDDY SMOKE RECORDER CO. had its exhibit in one of the power plants where it could be shown in active operation. Also during the last day of the convention the device was shown in the lobby of the Southern Hotel and attracted a great amount of attention from the delegates who are looking for economical operation of boilers.

MOREHEAD MFG. CO. showed a sample of its tilting trap, both return and non-return, and for vacuum systems. The special features were the Simplicitus valve mechanism, the Unit Trunion stand without gaskets and the Anti-stick trunion. M. L. Abrahams, of Detroit, was in charge.

LYONS BOILER WORKS, represented by William Lyons, of Chicago, had built for the convention a working model to exact scale showing the circulation in the Lyons combined water-tube and fire-tube boiler. The glass shell made it possible to study the water travel in the boiler and the generation of steam.

SCULLY STEEL & IRON CO. showed the Everlasting blowoff valve and the Perfection flue scraper, the advantages of these devices being demonstrated by the representative, H. B. Ham.

ERIE CITY IRON WORKS showed a model of the valve action of the new Lentz engine with balanced poppet valve which is being placed on the market by the company. Descriptive matter showing exactly the construction of this engine and its advantageous features was distributed and a watch fob showing the Lentz valve motion was given to visitors by the representative, S. Rosenzweig. This engine will have no packing on either piston or valve rods, using a water seal or oil seal in place of fibrous or metallic packing.

GARLOCK PACKINGS were shown in a case of samples of the different brands and styles and by rolls of the new No. 900 sheet fiber packing. C. D. Allen, manager of the Cleveland office, G. A. Morrison, of Cincinnati, Thos. C. Green, of Pittsburg, C. J. Carr, of Dayton, and E. A. Smith, of Cleveland, were the representatives and favored their friends with miniature packs of cards in celluloid cases.

THE LUNKENHEIMER CO. was disappointed in not having its souvenirs ready in time for the convention. The names of delegates were taken, however, and the souvenirs will be distributed by mail later on. The exhibit was one to attract the attention of all engineers, "The Valve" being the watchword and keynote on which all the display was based. The different lines of brass goods were arranged in circles and triangles in attractive form and consisted of sight feed cups and hand oil pumps, gage cocks, force feed lubricators, whistles, check valves, oil burners and other brass specialties. The booth was in charge of Lane Thompson, sales manager, Chas. Davies, chief inspector, Geo. K. Elliott, chief chemist, Arthur Brown, William Schmidt, and A. W. Dodds, of Pittsburg, and L. W. Kramer, of Cleveland.

REPRESENTING THE NATIONAL ENGINEER were S. J. Hamilton, manager, F. S. Kenfield, T. W. Bailey, E. W. Reilly and Editor John W. Lane.

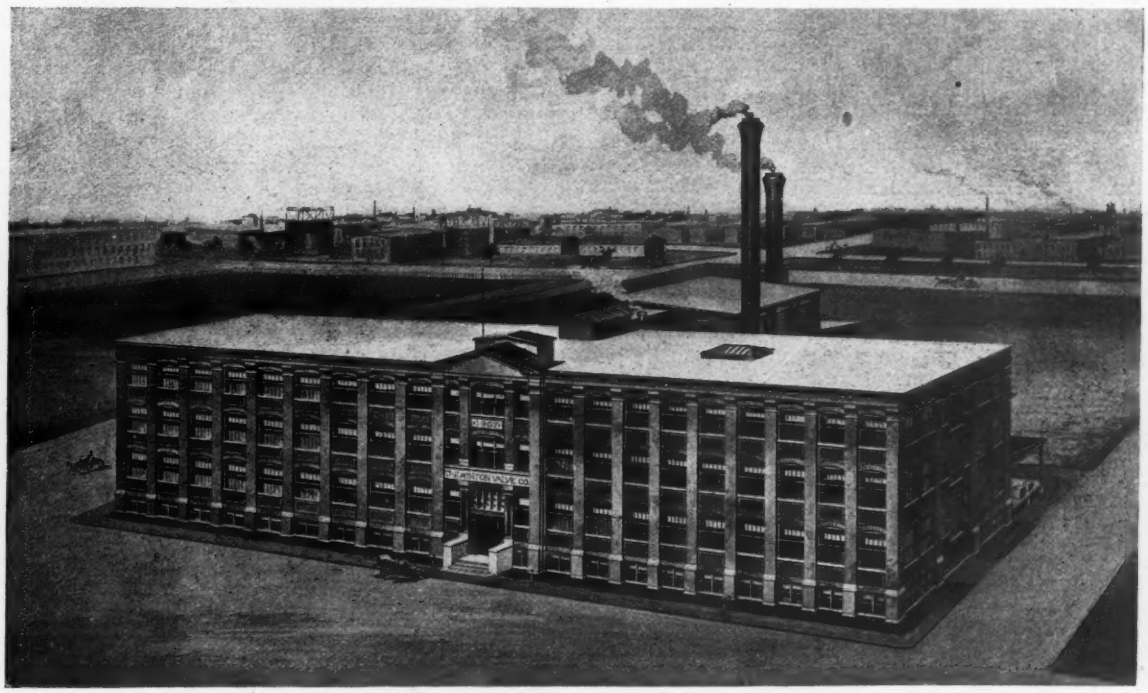
A NOVEL FEATURE of the exhibit was the naming of the different aisles as streets and avenues after distinguished inventors in power and electrical fields. The different names thus honored were: Faraday, Fulton, Reynolds, Corliss, Haswell, Ohm, Ampere, Watt and Franklin.

FISHER GOVERNOR CO. sent as its representative Geo. H. Beebe, secretary and general manager, who is now president of Iowa Association No. 11 and treasurer of the Iowa State Association.

THE NEW PLANT OF THE ASHTON VALVE COMPANY

It will be of interest to the many friends of the Ashton Valve Co. to know that it has recently moved its factory to the new building shown in the illustration located at 169 1st St., Cambridge, Mass.

The main building is 200 ft. long and 50 ft. wide, having 3 floors and a basement. In the basement are located the fireproof storage room, blacksmith department, and general stock room for rough brass and iron castings. The office, tool room, pattern shop, and shipping department are on the first floor, while the second floor is given over to the valve manufacturing department and valve buffing room. This floor opens to the second floor of the boiler house, where the valve testing is done.



NEW PLANT OF THE ASHTON VALVE CO.

The gage making, including buffing and nickel plating, takes up the entire space on the third floor. The dimensions of the foundry are 60 by 30 ft. and that of the boiler house is 50 by 30 ft. The equipment of the boiler house, consists of 2 water tube boilers, one especially for testing purposes and capable of carrying 400 lb. steam pressure.

All the buildings are of brick and concrete, slow burning mill construction, and the machinery is driven entirely by electric motors, operated on the group drive plan. Special attention has been given to lighting in the daytime working hours, all buildings having been fitted with as many windows as strength would permit. The artificial light used during the dark hours of the day is furnished to all buildings by electricity. The company recognizes the importance of good health on the part of all employes, and has installed the most improved sanitary arrangement on a liberal scale.

The business of the Ashton Valve Co. was established in 1872, and this change of location is a positive evidence of the growth of the company. The plant of the company at 271 Franklin St., Boston, has been dismantled, but one floor has been retained for a city office.

NOTABLE GAS REGULATOR

The G. M. Davis Regulator Co. has recently made a 16-in. gas pressure reducing valve of remarkable sensitiveness, which is installed at the Joliet plant of the Illinois Steel Co., and is used for reducing the pressure of furnace gas from a main line to a lower pressure suitable for the nozzles of gas fired boilers.

The initial pressure fluctuates between 6 and 12 oz. and the delivery pressure desired is 2 oz. The design of this valve was worked out by Mr. Davis with a view of constructing as near a frictionless automatic regulator as has ever been attempted. The controlling piston operates in a mercury seal which required 60 lb. to the fluid. The weighting toggle was of the lever and ball design with hardened steel knife edge bearings riding in ground steel bushings.

The entire inner valve and seats were of the Davis standard sleeve type ground as usual to perfect contacts.

In the test at the factory, this valve was so sensitive that by drawing in and out the breath through the low-pressure conveying pipe, the valve could be operated at will.

The valve was installed in service 2 months ago and maintains constantly an unvarying pressure of 2 oz. with the initial pressure varying from 6 to 12 oz., the approximate amount of gas passing through the regulator in 24 hr. being 7,000,000 cu. ft.

In view of the large size of this valve, its sensitive and accurate regulation is remarkable and Mr. Davis feels justly proud of a successful solution of a difficult problem.

"THE MORE YOU EXPECT, the more you will get."

AUTOMATIC CUT-OFF VALVE

Harmful results from failures in water tube boilers can be successfully prevented by installing an automatic cut-off valve. When one of these valves is installed between each boiler and the steam header it forms an automatic stop no matter where the break may occur.

The valve illustrated herewith, manufactured by the Lagonda Mfg. Co., Springfield, Ohio, is of the double-acting type, that is, it works equally well in either direction. Should a single tube in 1 boiler give way this valve will instantly isolate that boiler. On the other hand if a break occurs in the steam main between the boiler and the engine or for that matter in any part of the steam loop, all of the valves instantly close, preventing escape of steam.

This valve depends for its action upon the actual flow of steam and not upon the differences in pressures, and whenever abnormal flow occurs in either direction the valve instantly shuts. It takes the place

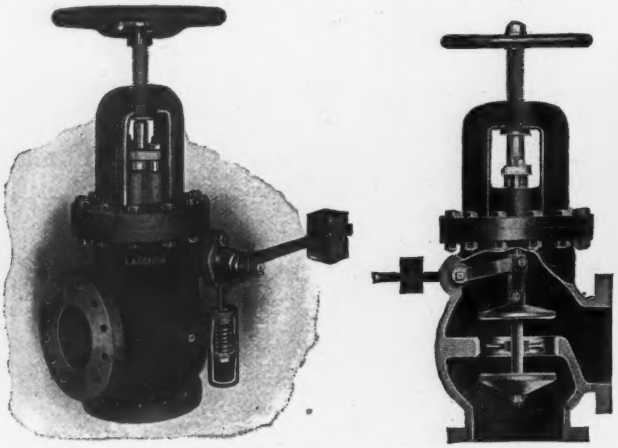


FIG. 1. THE LAGONDA AUTOMATIC CUT-OFF VALVE
FIG. 2. SECTIONAL VIEW OF LAGONDA CUT-OFF VALVE

of the ordinary stop valve and can be used as such, but should not be confused with the ordinary single action, non-return valve.

One important feature of the Lagonda valve is that there are no internal working parts. The dash pot on the outside is to prevent chattering or the closing of a valve too quickly or when sudden overloads occur.

To show the absolute reliability of this valve tests were made in Washington, D. C., last January before a Board of Supervising Engineers of the Department of Commerce and Labor.

These tests showed that when an opening was made between the valve and the boiler, equivalent to an outlet 1 5/16 in. in diameter, that the valves closed promptly. To show the action when a break occurs on the other side of the valve, a quick release valve was opened corresponding to an outlet of 1.5 in. in diameter. The valve closed in 2 seconds and the steam pressure was only reduced from 180 to 140 lb., the rush of steam closing the valve.

Other interesting tests were made which proved conclusively the reliability of the valve. To test its action under sudden overload a quick-release valve was opened corresponding to an opening of 1.5 in. Thirty seconds were consumed in opening the quick release valve this time, and the steam pressure dropped from 180 to 90 lb., but the automatic valve remained open. These tests prove that the valve can take care of any unusual but legitimate demand for steam, and still be sensitive enough to close quickly in case of accidents. By means of the dash pot and weight the valve can be adjusted to suit the local conditions of steam pressure and overload.

The Board of Supervising Engineers who witnessed these tests expressed their unqualified approval of the automatic valve and approved its use in all marine service. The valve is built in sizes from 3 to 12 in. A special low-down type is for use where head room is limited. Complete data on tests made on this valve can be had by writing to the Lagonda Mfg. Co., Springfield, Ohio.

PRESSURE-ALARM GAGES

The idea of having a pressure gage pointer make contacts for actuating an alarm, when pressures reach certain amounts, is not new, having been born of the desire to know automatically when undesirable pressures were approached. The standard pressure-alarm

FIG. 1. FRONT VIEW OF PRESSURE ALARM GAGE

gage for accomplishing this purpose is new and embodies improvements in design and construction which it is said adds greatly to its effectiveness.

In Fig. 1 a front view of this new instrument is plainly shown. Set behind the scale for indicating pressure is a hard fiber alarm dial bearing the high and low contact clips which are shown at 15 and 120 lb. respectively. These clips are adjustable and may be set at any points on the scale by unscrewing the front of the gage and slipping the contacts around on their curved contact rods. The contact rods are electrically connected to binding posts at the top of the case, 2 of which are shown in the engraving. A third binding post, the common return, is electrically connected to the alarm pointer through the case and movement.

Figure 2 is a rear view of the instrument with the back of the case removed. It is seen that there are 2 independent and distinct pressure tubes and movements, one of which actuates the indicating pointer and the other the alarm pointer. They are supported by the same mounting and there is but 1 pressure connection so that only 1 pressure transmission pipe is necessary to the instrument.

This independence of action is a feature of the standard gage which prevents interference, or the impairment of accuracy of 1 pointer and mechanism by the action of the other; i. e., the indicating pointer

will accurately follow the pressure up the scale even after the alarm pointer has reached its contact and stopped. The instrument, therefore, serves the double function of an accurate indicating gage and an alarm instrument which will unerringly give signals when pressures exceed safe and economic limits for which the contacts are set.

These gages are made up in the popular 5-in. dial size with brass or iron cases so as to match other

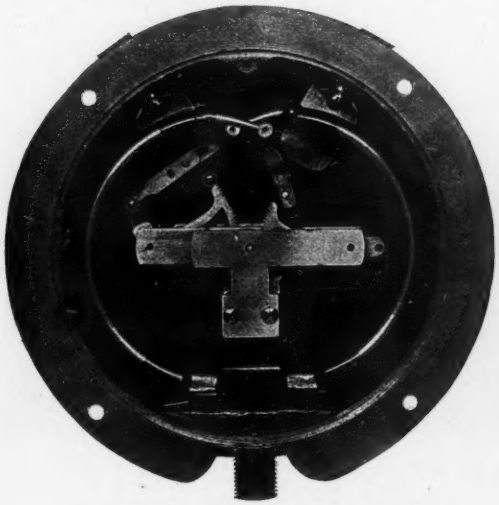


FIG. 2. REAR VIEW OF INSTRUMENT

gages on switchboard equipment. They can be made for any pressures and it is reported that those already put out have proven popular.

They are manufactured by the Standard Gage Mfg. Co. for which the International Instrument Co., of Foxboro, Mass., is the sales company.

IMPROVEMENTS IN THE MILNE WATER TUBE BOILER

These are notable and interesting additions made as the result of years of experience in operating and observing. An upper and a lower horizontal drum are connected by banks of tubes in outer curved rows and inner straight rows so arranged that suitable spaces between the banks provide access for cleaning inspection and repairs. Doors are set into the masonry opposite these spaces.

In each row the tubes are of uniform shape and interchangeable with large radius of curvature so that cleaning tools can readily be used. Removing 1 manhole plate gives access to an entire set of tubes.

Tubes are so staggered in vertical spacing that any one may be taken out and replaced without disturbing adjoining tubes or the setting.

As was to be expected, the vertical arrangement has proved in daily practice to have small tendency for ash and dust to collect, such material drifting into the rear chamber whence it is easily removed through the door provided for that purpose. Also on the interior of tubes, scale forming matter drops into the lower drum for the most part and can be blown out easily.

A novel improvement is the feed chamber shown in the lower drum, Fig. 2. Two rear rows of tubes are connected into this chamber, which is closed to the water in the rest of the drum, so that the incoming feed is not mixed with the boiler contents until it has been forced up through the rear tubes, a process which takes some 10 min., so that the temperature of the water is high before it is discharged into the upper drum; most of the scale-forming material is, therefore, precipitated to the feed water chamber below. This arrangement also brings the cool entering feed in contact with the gases as they are on the way to the flue, thus abstracting from them all possible heat and securing a proportionate economy of fuel.

By the use of a large lower drum, convenience in getting at tubes and a large added space for water storage are secured, and the upper drum, as will be evident from the drawing, gives ample steam liberating surface. The large area through the tubes gives even circulation, so there is no cause for priming, espe-

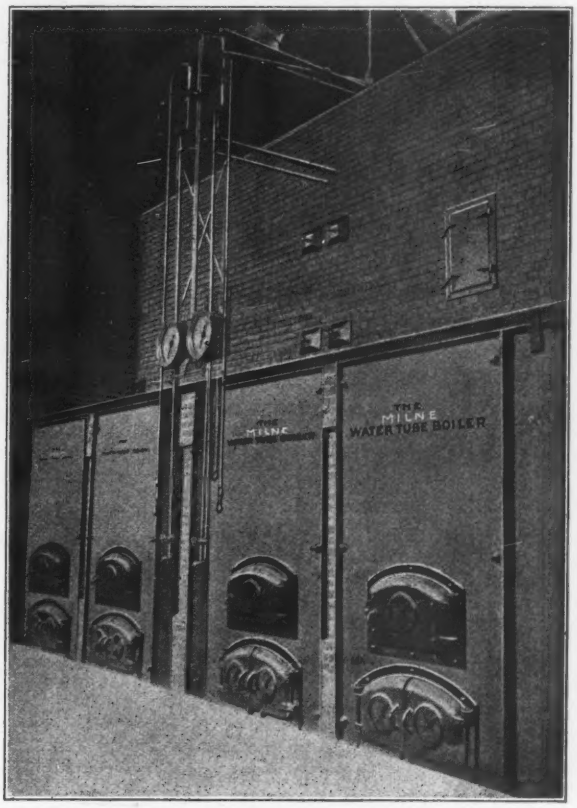


FIG. 1. MILNE WATER TUBE BOILER AND FURNACE

cially as feed water enters the upper drum at full boiler temperature. Steam is, therefore, produced dry under all conditions, however variable.

This construction leaves the upper drum clear, so that all tube joints are accessible, but when head room is limited, a dry pipe arrangement may be employed and the steam nozzle taken from the side of the drum.

A dutch oven furnace is used, having, however, an improved arch construction. Heavy channel beams set flush with the brick are used to bind the setting together, so that cracking of masonry is prevented, and a layer of concrete is used to tie the heads of the arch brick together.

The gases of combustion, leaving the furnace, rise upward, flooding the front bank tubes. A portion of the gases take a horizontal as well as vertical direction, but the baffle tile forces the bulk of the gases upward the full length of the tubes. At the upper

drum the gases turn and take a downward direction, thence turning again under the baffle tile in the rear bank of tubes and rising to the outlet.

Circulation is upward in the front bank of tubes, the velocity being very rapid on account of the high temperature, the large exposed fire surface and the absence of all restrictions. In the second bank of tubes the circulation is also upward, but with lessened velocity proportionate to the difference of temperature; and in the rear bank of tubes the circulation is downward through the 2 rows of tubes not connected with the feed chamber, and upward through the tubes that are connected with it.

The construction throughout is simple. No handhole plates, headers or flat stayed surfaces exist, and the floor space occupied is comparatively small. The boilers are made in all sizes from 150 to 1,000 hp. for all pressures by the Milne Water Tube Boiler Co., 154 Nassau Street, New York City.

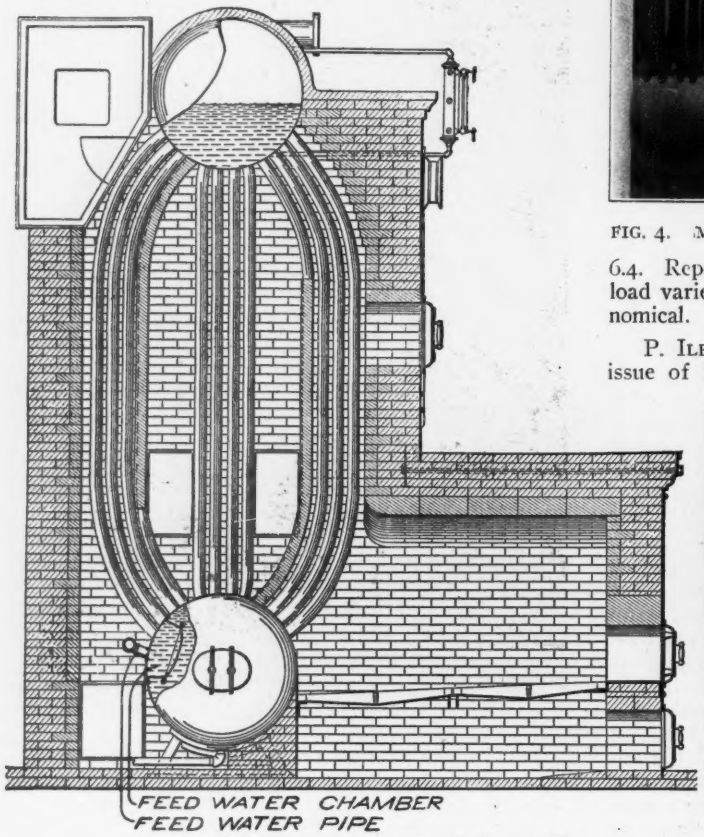


FIG. 2. SECTIONAL VIEW OF MILNE BOILER

GAS ENGINE RATING

In investigating the rating of gas engines, the Internal Combustion Engineers of Chicago endeavored to get the effective piston displacement per minute per rated horsepower (builders' rating), the effective piston displacement per minute per maximum brake horsepower which the engine would carry, and the relation of the maximum load to the most economical load considering fuel economy alone. It was found from 78 reports covering 314 engines or tests that for gasoline, the effective displacement in cubic feet per minute per measured rated horsepower ran for gasoline engines from 1.3 to 7.9, for city gas engines from 2.2 to 8.3, for producer gas engines from 2.6 to 9.2, for alcohol engines from 2.9 to 4.0. this discrepancy being partly due to the fact that the observations and reports were in some cases on engines that were obsolete. The effective piston displacement per cubic foot per minute per actual brake horsepower varies from 1.9 to

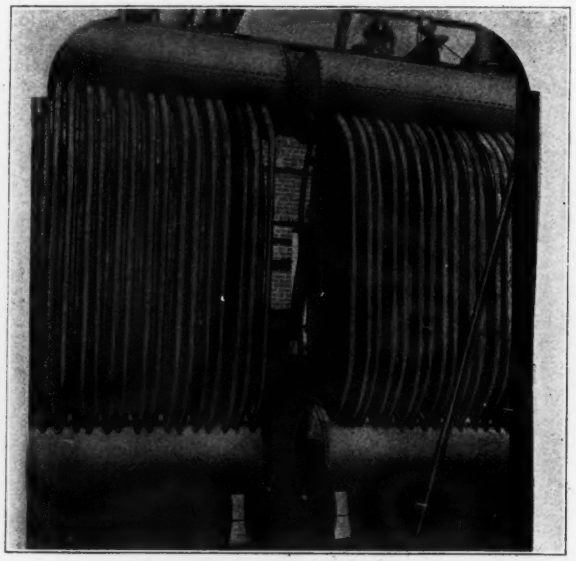


FIG. 4. MILNE BOILER SHOWING ARRANGEMENT OF TUBES

6.4. Reports as far as received show that the maximum load varies from 5 to 17½ per cent above the most economical.

P. ILES, OF MANCHESTER, ENGLAND, in the August issue of Machinery, states that he has often soldered

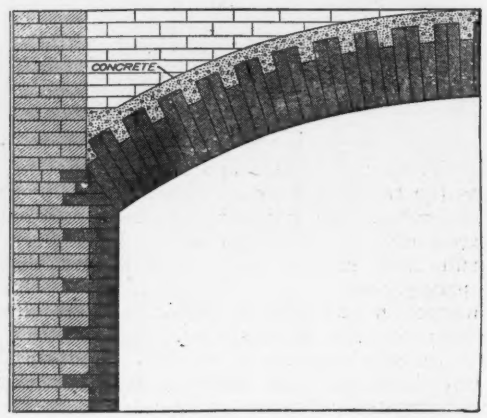


FIG. 3. FURNACE CONSTRUCTION

aluminum to copper and brass by first tinning the aluminum and the copper or brass using stearine as a flux, then wipe off clean, and use zinc chloride as a flux, with a solder composed of 67 per cent tin and 33 per cent lead.

STEAM PIPING FOR ENGINE CONNECTIONS are, according to Chas. L. Hubbard, in Machinery, usually figured on velocity of 6,000 ft. a minute for steam and 8,000 ft. a minute for exhaust pipes, assuming that the entire cylinder is filled at each stroke. This gives approximately 0.14 sq. in. internal area per horsepower for steam pipe and a 0.2 sq. in. per horsepower for exhaust pipe.

THE STORY OF A NEW YORK HOUSE AND ITS PRODUCT

IT'S a far cry from Achnacarry Castle, the Pibroch of Donald Dhu, and the heroic deeds of the Scottish Highlanders in the stirring days of '45, to these piping times of peace in the year of our Lord, 1909 A. D., and Little Old New York; and the story of those early lilting days has been told delightfully by Scotia's bard in the immortal verse of "Marmion" and the "Lady of the Lake."

FIG. 1. THE BADGE OF CLAN CAMERON AND THE TRADE MARK OF THE CAMERON PUMP

Clan Cameron was famous for its martial exploits, always loyal to the Stuart cause, and played an important part in the '45. "The Scottish regiment of Cameron Highlanders was originally raised from this

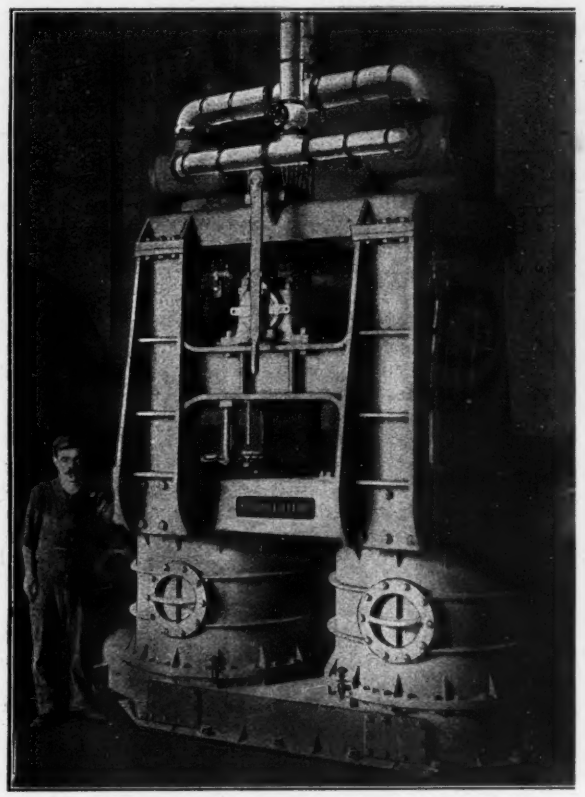


FIG. 2. CAMERON VERTICAL TWIN BEAM AIR PUMP AS USED ON THE "NORTH CAROLINA" AND "MONTANA"

clan. Their badge is the 'Oak,' and the head of the clan is Cameron of Lochiel, whose residence is Achnacarry Castle. The famous 'Pibroch of Donald Dhu' is their battle march."

Yet even in these prosaic days, when the hunt for the almighty dollar in the busy marts of trade has taken the place of the chase, and the horn of the hunter is no longer heard on the hills, romance weaves itself about reality like the vine around the oak, and history repeats the experiences of the past, while the pursuit of a livelihood is not entirely bereft of charm, as "Peace hath her victories no less renowned than War."

Nearly 50 yr. ago, a bright young Scotchman, Adam Scott Cameron, sought and obtained release from the bonds of apprenticeship, to enter into busi-

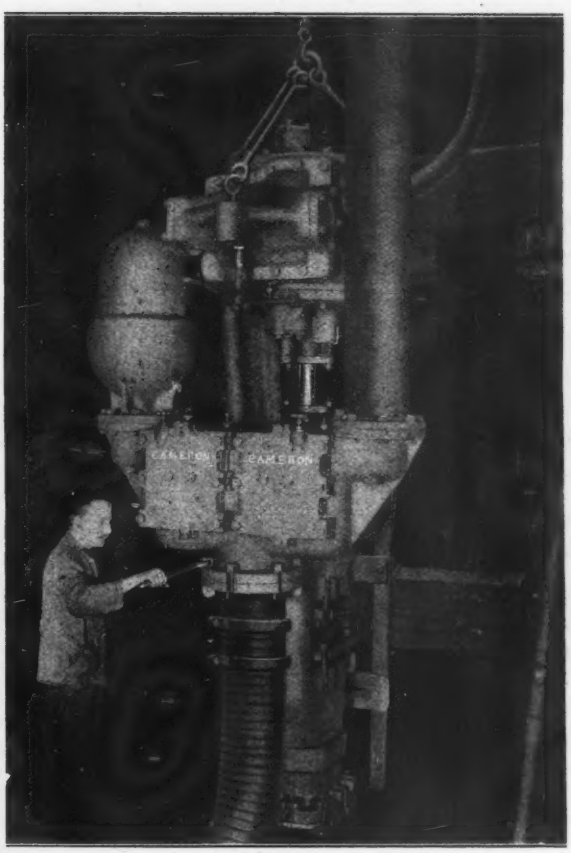


FIG. 3. VERTICAL SINKING PUMP USED IN SHAFT AND MINE OPERATIONS

ness for himself as a machinist, his chosen profession, and while yet in his teens. His working hours were given to the practice of his trade, while his evenings, often far into the night, were devoted to study and research, for no pent up Utica was to confine his powers.

Graduating with honors from Cooper Institute, he bent his mind and energies to the production of something better than the crude appliances in vogue at that time as pumping machinery, evolving and perfecting the Cameron, operated with no outside valve mechanism. Like many another, he builded better than he knew; and today, his invention stands practically as he created it.

Commencing in a little room in the building at the northeast corner of Second avenue and East 22d street, tenanted by many small manufacturers, he increased his business until he had the whole floor, and finally, his darling ambition became a reality, and he

was enabled to purchase the property and erect a plant on the premises still occupied, covering almost the entire block on East 23d and 24th streets, bounded by Avenue A and First avenue.

From this establishment went forth the first pumps used in the pipe line industry, pumping oil from the wells to the receiving tanks in Col. Drake's earlier strikes in western Pennsylvania. From the same establishment the Municipal Ferry Boats of Greater New York received their entire pump equipment, while the new armored cruisers North Carolina and Montana, the best of that class to date, are supplied wholly with Cameron pumps.

The history of one man's invention, perpetuated by his widow and successor, is over 60,000 pumps in use the world over.

From the ice bound mills of Alaska down through the Dominion and the States, in the gold mines of the Rockies and Sierras; the silver mines of Old Mexico

FIG. 4. LOOKING DOWN ON A CAMERON PUMP AT THE BOTTOM OF A PENNSYLVANIA TUNNEL SHAFT FOR HANDLING DRAINAGE WATER

and Central America; on both sides of the Andes, in Brazil and along the East Coast, as well as Chili and Peru bordering the Pacific, from the Islands of the Sea, from Greenland's icy mountains and India's coral strand, from the mines of the Transvaal in Darkest Africa, from Nippon and far Cathay, from the sulphur mines of Italy, from the ore mines of Spain, from the dikes of Holland and refineries of Belgium, and wherever merit and worth are appreciated, have come orders for the old reliable Cameron.

And in the Cameron's own bailiwick, New York City, it has played no small part. In the subways, in the tunnels under the Hudson and East rivers, in excavations for bridge foundations, the Cameron has played its part and has been relied on confidentially to keep the work clear of water.

To those who would desire to become acquainted, the Cameron latch string is on the outside, and it requires only a gentle pull to invade the sanctum sanctorum.

To such as are compelled to deny themselves this pleasure is offered such consolation as a complete catalogue affords to intending purchasers. May the shadow of the Cameron never grow less.

CATALOG NOTES

HOPPES STEAM SPECIALTIES are fully illustrated and described in a new 40-page catalog just being issued by the Hoppes Mfg. Co., Springfield, Ohio. This catalog explains very clearly the Hoppes System for heating and purifying boiler feed water by means of Hoppes live steam feed-water purifiers and exhaust steam feed-water heaters and purifiers as also the method of removing moisture and oil from steam by means of Hoppes steam separators, oil eliminators and exhaust heads. Copy of this catalog will be mailed to anyone interested upon request addressed to the above company.

FROM THE SUCRO FILTER CO. of 42 Broadway, New York City, comes an interesting description of the method of getting pure water by gravity filtration with the Sucro system. It shows the method of use both for private flats and for large installations.

FROM FOREST TO FACTORY describes in interesting and instructive style, the manufacture of Balata belting, showing how the material from which the coating is made is gathered, how it is worked up into belting, the tests that are applied to insure proper strength and construction and the method of application of the Balata belt. It is not only interesting, but it is a handsome catalogue and well worth getting. It is supplied by the New York Leather Belting Co. of 51 Beekman St., New York City.

NATIONAL PUMPING MACHINERY made by the National Steam Pump Co. of Upper Sandusky, O., is a complete list of sizes and styles adapted for all classes of work and gives a complete description of the details of the National Pump in a handsome 130 page catalogue with a special embossed cover design which has just been printed by the company.

SCAVENGING GAS ENGINES as made by the Jacobson Engine Co. of Chester, Pa., are described and finely illustrated in a series of folders recently received. These engines are made in the horizontal and in the vertical multiple cylinder type from 40 to 200 hp. and from 30 to 900 hp. in the vertical. They are especially designed for places where a close speed regulation is required.

THE INTERNATIONAL ACHESON GRAPHITE CO of Niagara Falls, N. Y., has just issued a new folder descriptive of its various products, which include electrodes, dry battery filler, paint pigment, electrotyping leads, graphite for lead pencils, firearms lubrication, general lubrication, and a very superior line of graphited greases. The folder is handsomely printed in 2 colors, and will be appreciated by many as a catalog in miniature of the Acheson-Graphite products, which continue to win high favor because of their uniform quality and merit. The company cheerfully sends the folder, 295D, on request.

SIGHT FEED OIL PUMP CO., of Milwaukee, Wis., is getting out a new Model C of the Richardson sight feed oil pump, the novel features of which are described in Bulletin 208 sent out by the company. This is a "something better" pump for small size engines, built with 1 or 2 feeds and with glass tanks of several capacities, the rate of feed being clearly visible.

H. W. JOHNS-MANVILLE CO. has just issued 2 pamphlets, one illustrating and describing Morris metalic packing and the other tells the uses of the J. M. Regol Anti-Leak Stick. These pamphlets may be had for the asking and the information they impart is well worth knowing.

FROM THE SAWYER BELTING COMPANY comes No. 8 of Vol. 2 of the Sawyer Belting Booster

which shows the style and lengths and w... the Sawyer Ambestos Stitched Belting which the co. pany keeps in stock. This Bulletin is sent out each month for the convenience of patrons.

THE LEADING COMMERCIAL SYSTEMS of exhaust-steam heating are well described and illustrated in a 48-page, 6 by 9 in. book, issued by the Harrison Safety Boiler Works, Philadelphia, Pa. The drawings show several varieties of both the gravity return and the so-called vacuum systems in which a vacuum pump or ejector is used for withdrawing water and air from the radiators. There are also several variations from these 2 main types, such as those using combined regulation, that is, one radiator for steam and another for the hot returns, the positive differential system in which a constant difference of temperature is maintained between the radiator system and the return piping, in order that a simple type of valve may be used at the outlets of the radiators, etc. One section of the book is taken up by a comparison of different systems of piping open feed water heaters when installed in connection with such exhaust steam heating systems, and by means of comparisons in different colored inks the reduction in complexity and cost and the improvement in convenience attained through the use of the new Cochrane Steam-Stack and Cut-Out Valve heater and receiver are effectively shown. In the latter part of the book several methods are described by which space in crowded boiler rooms, as in basements of office buildings, hotels, etc., can be economized still further by specially constructed heaters. There is finally a brief description of a special heater designed to purify the make-up water as well as to act as heater and receiver for the condensed returns from the heating system. A feature which will undoubtedly be of interest to architects, owners, etc., is a model specification covering a heater and receiver for use with exhaust steam heating systems.

SMOOTH-ON MFG. CO has just received from the printers the 8th edition of its Instruction Book on How to Make Repairs in Piping and Castings. The book is fully illustrated, shows many of the different ways in which Smooth-On cements have been used, and the fact that an 8th edition is now necessary within a short time of publication shows the use that it has been found by engineers. It will be sent free to anyone sending his name and business occupation to the Smooth-On Mfg. Co., Jersey City, N. J.

TRADE NOTES

THE DEMAND, WHICH RECENTLY led the General Electric Co. to extend its production of tungsten lamps into voltages from 200-250, also included the other metallic filament lamps. In response to this demand, the company has formally listed and is now producing tantalum lamps adapted for the higher voltages, thus obviating the inconvenience of having to operate 2 tantalum lamps in series. These 200-250 volt tantalums—50 and 80 watts respectively—have given most excellent results on service tests, their life averaging fully up to that of the regular 100-130 volt tantalums of the same efficiency, 2 watts per candle.

THE BURT MANUFACTURING CO. recently received the following letter from the officer in charge of aeronautics, Ft. Omaha, Neb.: I have the honor to inform you that the ventilators furnished by your firm have been installed on the balloon house at this station with the following results: Temperature in balloon house 3 ft. from concrete floor, 90 deg.; temperature, with ventilators closed, 4 ft. from iron roof, 100 deg.; temperature, with ventilators open, 4 ft. from iron roof, 96.5 deg. Ventilators when open have a tendency to draw up all dust and smoke from the lower part of building, which fact not only makes the atmosphere purer, but also has the effect of making it feel cooler than it really is. The ventilators are satisfactory. If there is any error in this report, a correction would favor the ventilators.

RECENT INSTALLATIONS in which the specialties manufactured by the Hughson Steam Specialty Co., including reducing valves, back pressure valves, etc., have been installed are in part as follows: The La Salle Hotel, University Club and Cable Building, Chicago; Missouri-Pacific Railroad Shops; Atlantic Mills, Olneyville, R. I.; Glenlyon Dye Works, Saylesville, R. I.; Boston & Albany Railroad, Springfield, Mass.; General Electric Co., Pittsfield, Mass.; Pfister & Vogel Leather Co., Milwaukee, Wis.

MUCH HAS BEEN WRITTEN and spoken in regard to the need of lubrication, elaborate formulas have been given for testing the different forms of lubricants, and articles have been written with a view to exploiting all kinds of products of this nature. A long course of education on the subject of oils and greases is not, however, essential to the engineer, but it is imperative that he should use a first-class article or he will have occasion to learn rapidly in the school of a very expensive experience.

To get a perfect lubricant and one that has merit, the primary object should be to select a product which has a high reputation gained because of satisfaction given. The next thing to learn is where and how to apply it, as too much oil and grease means waste and produces other unsatisfactory results. Albany Grease, which the manufacturers, Adam Cook's Sons, 330 West St., New York, state to be the first lubricant in the field of its kind, which has been in practical use on all kinds of machinery for over 40 yr., giving good results under even the most adverse conditions, is practical and has been used extensively in every portion of the power plant where a solid lubricant can be employed.

The makers state that this grease is always uniform in quality, is cleaner than oil, does not drip, splash or waste away, stays where it belongs and does the work that it is supposed to do, and that a little goes a long way and the way is made a smooth one. This grease is made in 7 densities, designated by numbers beginning with 0 and including 1, 2, 3, X, XX, and XXX, for different conditions and temperatures. Convenient packages are 1, 5, 10, 25, 50-lb. cans, kegs, half-barrels, and barrels.

ALL WHO HAVE OCCASION to use blue print paper for any purpose, either reproducing tracings or making blue print photographs, will find that the new Keuffel & Esser papers will give very satisfactory results. These papers are the result of an endeavor to improve the formula for coating blue print and to produce papers best adapted for the purpose for which it is made. The paper, which is called the Helios, is made in 3 grades, the Regular, which is a good keeping paper and prints in from 4 to 8 minutes' exposure in bright sunlight, a Special Quick paper where hurried work is required, but which does not keep as well and requires more care in handling than the Regular, and an Electric Quick, for use with electric light and in printing machines. While the ordinary paper, as made by the Keuffel & Esser Co., Hoboken, N. J., is sent out in rolls, the company is prepared to furnish this paper cut in sheets where a reasonably large order is placed. A book, "Photo Printing from Tracings," giving full directions, will be mailed free on application.

PRACTICAL ENGINEER CLASSIFIED ADVERTISEMENTS

Advertisements in this section are inserted under regular headings at the rate of 40 cents per line. About nine words make a line. No display type is allowed, but the first three words may be set in capital letters. Minimum space sold, two lines.

Under classification, "Positions Wanted," advertisements not exceeding four lines will be inserted for subscribers once free of charge.

To insure proper classification, copy must reach this office on or before the 15th of month preceding publication.

Positions Wanted

POSITION WANTED—A high-grade refrigeration engineer wishes to change his position. A-1 references. Address Box 116, Practical Engineer. 9-2

POSITION WANTED—By strictly sober man as steam or gas engineer. Hold same position now, but have reasons for change. Good references and hold Ohio state license. Address Box 117, Practical Engineer. 10-2

POSITION WANTED by engineer of 9 years' experience. Employed in present position the last 4 years. Either water works or A. C. and D. C. power plant. Married, sober and steady. Address Box 112, Practical Engineer. 9-2

POSITION—Young man, 20 years old, wants position as fireman's helper. All around man in place with a chance to make good and learn business. Few months' experience in small office building plant. Strictly sober, attentive and willing to learn. Dominick Cavalla, 245 Pacific St., Brooklyn, N. Y. 10-2

POSITION WANTED as engineer. Have had 16 years' experience with all kinds of boilers, pumps and generators. Economy guaranteed. Will be at liberty November 1st. Give full particulars in first letter. Location not important. Address Wm. J. Collins, Box 2751, 21st and Fairmount avenue, Philadelphia, Pa. 9-2

POSITION WANTED by chief engineer as chief or superintendent in railway or light plant. Am now chief of railway plant but desire a change for best of reasons. Technical education, experienced with Corliss high speed engines and turbines, water tube boilers and all power plant appliances. Five years with present employer. Age 28, married. Address Box 115, Practical Engineer. 9-2

POSITION WANTED—By engineer, 26 years old, 8 years' experience with high speed automatic and Corliss engines, A. C. and D. C. generators, air compressors, water and fire tube boilers, stokers. Hold first class license for Ohio. Own indicator and tools; married; use no liquor or tobacco. I. C. S. man. Will take charge of any plant up to 2,500 H. P., middle west or west. Will be free Dec. 1. State salary. Address Box 118, Practical Engineer. 10-2

Help Wanted

NICE SIDE LINE for steam specialty salesmen. Reiter Boiler Cleaner Co., Elgin, Ill. 9-tf

AGENTS WANTED—In every state for steam and other specialties. A-1 references required. Ideal Mfg. Co., Aurora, Ill. 10-1

AGENTS WANTED to sell Burgmann celebrated engine packings in territories not yet covered. See our advertisement on page 14 of this issue. 9-tf

WANTED IMMEDIATELY—Operating engineer for station containing 2 units, 1,000 H. P. each, Allis Chalmers producer gas engines, direct connected to alternators. First class, experienced steam engineer will be considered. Address Southwestern States Cement Co., Jackson, Mich., giving age, salary and experience. 10-1

ENGINEERS AND MECHANICS—To make big money selling Incomparable "ZIZ" Hand Soap. A 10-cent can will instantly remove more dirt and stains from the hands than four cakes of any soap made, and it will not injure the most delicate skin. Small sample free. Byram Mfg. Co., Box 3133, Boston, Mass. 4-tf

Wanted

WANTED—March, 1908, issue of Practical Engineer. Subscription extended two months for it. Practical Engineer, Chicago, Ill. 10-1

For Sale

FOR SALE—All kinds of high grade rebuilt engines, boilers, etc. See list in display advertisement in another part of this issue. The Randle Machinery Co., 1767 Powers St., Cincinnati, O. 10-tf

FOR SALE—60 steel storage tanks, 6,000 gallons' capacity. Good as new. Double riveted, extra well built. Suitable for storage of oils, waters or liquids of any kind. 100 steam pumps. Get our prices on engines, boilers and electrical machinery. All sizes and kinds. Chicago House Wrecking Co., 35th and Iron Sts., Chicago. 4tf

Machinery For Sale.

FOR SALE—One 175-hp. and one 60-hp. General Electric motor, practically new. Carr, Ryder & Adams Co., Dubuque, Iowa. 9-2

FOR SALE—ENGINES AND BOILERS—Corliss—Heavy Duty, 18 x 36 Ohio, 24 x 30 Clark, 22 x 48 Allis. Girder Frame, 14 x 30 Bass, 18 x 42 Allis, 22 x 42 Hamilton, 28 x 54 Hamilton. Automatic—All sizes, 30 to 400 hp. Send for list. Throttling engines from 10 to 100 hp. Woodworking machinery of all kinds. Cleveland Belting & Machinery Co., 1922 Scranton road, Cleveland, Ohio. 9-tf

"THE TOOL-MONGER," name given to a booklet of 288 pages which we shall be pleased to mail on request. Valuable to all users of mechanics' tools. Montgomery & Co., 105-107 Fulton street, New York City. 9-2

Educational and Instruction

ELECTRICITY AND PLUMBING taught by practical work. Write for illustrated catalog. Coyne National Trade Schools, 826 N. Ashland, Chicago. 9-2

Books

"THE BOILER," by Stephen Christie. Every engineer will profit by a study of its contents. 6 x 9, 264 pages. Cloth bound, $1.00. Stephen Christie, 171 La Salle street, Chicago. 10-1

Patents and Patent Attorneys

PATENTS—Watson E. Coleman, Patent Attorney, Washington, D. C. Advice and books free. Highest references. Best services. 4-tf

PATENTS—For a Canadian or foreign patent send sketch for free report. Patentability certificate given. Canadian patents taken up for sale if desired. Send ten cents for booklet and inventors' monthly magazine. Ben. B. Pannett, Ottawa, Ontario, near Patent Office. 9-tf

HAVE YOU AN IDEA? If so write for our books: "Why Patents Pay," "What to Invent," "100 Mechanical Movements" and a Treatise on Perpetual Motion—50 illustrations. All mailed free. F. Dietrich & Co., Patent Lawyers and Experts, Oray Block, Washington, D. C. 9-tf

THE INVENTORS' UNIVERSAL EDUCATOR tells all about patents and how to secure them. Has 600 mechanical movements, also 50 perpetual motions. Every inventor should have a copy. Price $1.00 by mail. Address F. G. Dieterich, Oray Bldg., Washington, D. C. 9a10-tf

PATENTS—C. L. Parker, late Examiner, U. S. Patent Office. Attorney-at-Law and Solicitor of Patents. Patents secured promptly and with special regard to the legal protection of the invention. Handbook for inventors sent upon request. 186 McGill Building, Washington. D. C. 4-tf

Miscellaneous

ENGINEERS—Pack your Corliss valve rods with Ideal Metallic Packing. Three years' guarantee. Price per inch diameter of rod $1.00. Ideal Metallic Packing Co., South Stillwater, Minn. 8-tf

STEAM ENGINEER'S SLIDE RULE gives M. E. P. for steam and air. Send fifty cents for full size working model, including coupon worth fifty cents. F. F. Nickel, Box 391, Hazleton, Pa. 8-tf

FREE, ANY FIRM owning a steam plant, or any engineer in charge of steam plant, that is troubled with scale and has to use boiler compound can get the best indicator and reducing wheel made, free. Address Great Lakes Chemical Co., Manitowoc, Wis. 10-tf